

# A Report to Congress on Long-Term Stewardship

## Volume I – Summary Report

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U.S. Department of Energy  
Office of Environmental Management



Office of Long-Term Stewardship

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## AT A GLANCE...

# A Report to Congress Detailing DOE's Existing and Anticipated Long-Term Stewardship Obligations



Long-term stewardship is a critical element for continued progress in site clean-up and closure. DOE is already performing long-term stewardship activities at 34 sites that have been cleaned up and closed and at portions of many other sites.

The Department of Energy has prepared its most comprehensive report to date on its anticipated long-term stewardship obligations for sites that will continue to have residual wastes or contamination after cleanup has been completed. The *Report to Congress: Long-Term Stewardship* (January 2001) recognizes that:

- DOE has been, and intends to continue, performing waste cleanup to standards that do not allow for unrestricted land use (e.g., industrial or recreational) in most cases;
- Even if unrestricted land use were to be sought, it is often technically and economically infeasible;
- Consequently, long-term stewardship will be required for many years into the future; and
- Given the need for long-term stewardship to ensure the continued effectiveness of cleanup work DOE intends to establish reliable management plans to carry out the long-term stewardship mission.

**DOE's obligation for long-term stewardship** includes all activities necessary to protect human health and the environment at sites that will continue to have residual wastes or contamination. Activities include:

- **Institutional controls** (e.g., surveillance, record-keeping, inspections, access control, and posting signs); and
- **Engineered controls** for preventing migration of residual wastes or contamination (e.g., ongoing pump and treat operations, groundwater monitoring, cap repair, and maintenance of entombed buildings and other structures or barriers).

**Following site cleanup and closure, residual wastes or contamination will remain** at some sites or portions of sites, including:

- Former uranium mill sites and mill tailings disposal sites;
- Radioactive and hazardous waste burial grounds;
- Residually contaminated soil and groundwater; and
- Entombed buildings and structures.

**DOE expects to conduct long-term stewardship activities at more than 100 sites.** These sites include:

- 67 sites where cleanup is completed now or will be completed by 2006 but residual wastes or contamination will remain;
- 29 sites where cleanup of portions of the sites will be completed by 2006; and
- Potentially, as many as 33 additional sites where remediation and associated long-term stewardship activities have not yet been determined at this time but DOE may be responsible for long-term stewardship after 2006.

**The FY2000 NDAA Long-Term Stewardship Report** contains the most comprehensive compilation to date of existing and anticipated long-term stewardship requirements at DOE sites. The Report:

- Fulfills a Congressional requirement to provide an accounting of DOE's long-term stewardship activities at sites and portions of sites as of 2006;
  - Provides plans for DOE's obligations after sites are cleaned up and closed and serves as a baseline for more detailed planning;
  - Identifies the scope and timing of existing and anticipated long-term stewardship activities (summarized in Volume I and on a site-specific basis in Volume II);
  - Provides preliminary cost estimates for long-term stewardship activities; and
  - Identifies key next steps and issues to be resolved in order to better plan and manage long-term stewardship activities.
- For electronic copies of this report please visit our long-term stewardship information center website at <http://its.apps.em.doe.gov/center/>
- To obtain copies of this Report or for more information on the environmental management activities of the U.S. Department of Energy, contact The Environmental Management Information Center at 1-800-736-3282.
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[Table B-1](#) in Appendix B of this volume provides links to the individual states in Volume II.





Boxes containing low-level radioactive waste lie in a shallow land burial trench at the Savannah River Site. New methods for disposal of low-level waste are being developed by the Department. *Savannah River Site, South Carolina. January 7, 1994.*

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**Low-Level Waste Disposal Site.** This engineered trench at the Savannah River Site contains approximately 30,000 stacked carbon-steel boxes of waste with each box measuring 4 by 4 by 6 feet. In 1996 the trench was backfilled with dirt to form a mound, which was seeded with grasses and sloped to reduce runoff. Long-term monitoring and maintenance will be needed to ensure the integrity of this waste containment system.

*Engineered Low-Level Trench 4, Savannah River Site, South Carolina, January 1994.*



**Below Ground Waste Disposal Silos.** These concrete domes form the caps for underground silos at the Oak Ridge Reservation, each measuring 8 feet in diameter. These disposal silos are 15-20 feet deep and were placed in the ground at least two feet above the highest known groundwater levels. These silos were used from 1986 to 1993 for the disposal of laboratory equipment, construction debris, and other dry waste contaminated principally with cesium-137, strontium-90, and cobalt-60. Although no final cleanup decisions have been made, long-term groundwater monitoring is currently being conducted and may be required for decades. *Melton Valley Area, Solid Waste Storage Area 6, Oak Ridge Reservation, Tennessee, January 1994.*

# Chapter 1

## Introduction and Background





## CHAPTER 1: INTRODUCTION AND BACKGROUND

During World War II and the Cold War, the Federal government developed and operated a vast network of industrial facilities for the research, production, and testing of nuclear weapons, as well as for other scientific and engineering research. These processes left a legacy of radioactive and chemical waste, environmental contamination, and hazardous facilities and materials at well over a 100 sites in 30 States and one U.S. Territory. Hundreds of thousands of acres of residually contaminated soils, contaminated groundwater, surface water and sediment contamination, and contaminated buildings are present at many sites across the country. These sites range in size from less than one acre, containing only a single facility, to large sites spanning over 100,000 acres with huge uranium enrichment plants and plutonium processing canyons.

Since 1989, the U.S. Department of Energy's (DOE) Environmental Management (EM) program has made significant progress in addressing this environmental legacy. Millions of cubic meters of waste have been removed, stabilized, or disposed of, resulting in significant risk and cost reduction. In addition, DOE began disposing of transuranic (i.e., plutonium-contaminated) waste in the nation's first deep geologic repository – the Waste Isolation Pilot Plant in New Mexico. DOE is now carrying out its long-term stewardship obligations at dozens of sites, including smaller sites where DOE has completed cleanup work for the entire site and many larger sites where DOE has remediated portions of the site.

DOE generally conducts cleanup activities to achieve standards allowing for reasonably foreseeable land use.<sup>1,2</sup> In some cases, the agreed-upon cleanup levels meet the “reasonably anticipated future land use” standard but do not allow for unrestricted use (i.e., some sites will be restored to a level appropriate for use other than unrestricted or residential use). Furthermore, at this time, due to the nature and extent of contamination, it is technically and economically infeasible to restore many DOE sites to levels

### WHAT IS “CLEANUP”?

The term “cleanup” in the context of DOE's Environmental Management (EM) program is often confused with the vernacular use of the term to mean that contamination has been eliminated to a pristine, pre-contamination condition. However, in the environmental remediation business, the term “cleanup” refers to the process of addressing contaminated land, facilities, and materials in accordance with applicable requirements. Cleanup does not imply that all hazards will be removed from the site. This function encompasses a wide range of activities, such as stabilizing contaminated soil; treating groundwater; decommissioning process buildings, nuclear reactors, chemical separations plants, and many other facilities; and exhuming sludge and buried drums of waste. The term “remediation” is often used synonymously with cleanup.

In *Accelerating Cleanup: Paths to Closure*, the Department defines site cleanup as complete when the following five criteria have been met.\*

- Deactivation or decommissioning of all facilities currently in the EM program has been completed, excluding any long-term surveillance and monitoring.
- All releases to the environment have been cleaned up in accordance with agreed-upon cleanup standards.
- Groundwater contamination has been contained and long-term treatment (remedy) or monitoring is in place.
- Nuclear materials have been stabilized and/or placed in safe long-term storage.
- Legacy waste has been disposed of in an approved manner (legacy waste was produced by past nuclear weapons production activities).

\* *Accelerating Cleanup: Paths to Closure*, DOE/EM-0362, June 1998. “Status Report on Paths to Closure” U.S. Department of Energy Office of Environmental Management, March 2000.

<sup>1</sup> For information on how reasonably foreseeable land use assumptions are developed, see *Land Use in the CERCLA Remedy Selection Process*, U.S. Environmental Protection Agency, OSWER Directive No. 9355.7-04, May 25, 1995.

<sup>2</sup> Also see *RESRAD Manual for Implementing Residual Radioactive Material Guidelines* (Yu et al. 1993), Version 5.0.

acceptable for unrestricted use.<sup>3</sup> Therefore, many contaminated soil areas will not be suitable for residential use; contaminated groundwater plumes may not be restored for potable uses for many years into the future; and contaminated surface waters may not be remediated because doing so will create extensive damage to ecological systems.

At the time cleanup is completed, most sites will transition into the longest “phase” of the environmental life cycle – that of long-term stewardship. The activities necessary to ensure protection of human health and the environment from hazards remaining after cleanup, stabilization, or disposal are referred to as “long-term stewardship.” Long-term stewardship activities are directly linked to the types of cleanup actions being performed.

#### **LONG-TERM STEWARDSHIP**

For purposes of this Report, “long-term stewardship” refers to all activities necessary to ensure protection of human health and the environment following completion of cleanup, disposal, or stabilization at a site or a portion of a site. Long-term stewardship includes all engineered and institutional controls designed to contain or to prevent exposures to residual contamination and waste, such as surveillance activities, record-keeping activities, inspections, groundwater monitoring, ongoing pump and treat activities, cap repair, maintenance of entombed buildings or facilities, maintenance of other barriers and containment structures, access control, and posting signs.

Long-term stewardship, as used in this Report, is distinct from two other stewardship programs - the Nuclear Materials Stewardship Program, which provides for management and disposition of nuclear materials that are used or being stored at DOE sites (including the storage of materials not defined as waste for which there is no planned future use), and the Stockpile Stewardship Program, which is intended to ensure the safety and the reliability of the existing stockpile of nuclear weapons.

Decisions regarding what to do with contaminated soils or facilities, and the subsequent cleanup actions taken to implement these decisions, will result in a specific end state for the site. For some sites (e.g., those with disposal cells), the current status of monitoring contained contamination will represent the final end state. In other words, no additional work is anticipated unless an unexpected condition occurs (e.g., remedy fails). For other sites (e.g., sites with entombed reactors, containment systems), the long-term stewardship phase represents a point where hazards are controlled, yet additional work may be required. For these sites, long-term stewardship represents an “interim” phase until new technologies become available or existing technologies can be deployed at a more reasonable cost.

### **1.1 PURPOSE OF THIS REPORT**

The *Fiscal Year 2000 National Defense Authorization Act* (FY 2000 NDAA) Conference Report requested the Secretary of Energy to submit to Congress a Report on DOE’s existing and anticipated long-term stewardship obligations at sites where environmental restoration activities are complete or will be complete by 2006. The primary purpose of this Report is to respond to that request.

The request for this Report in the FY 2000 NDAA reflects a continuing Congressional interest in long-term program costs and management. First, Congress is increasingly aware that DOE’s responsibilities will not be eliminated when “cleanup” is complete and is interested in understanding the estimated size of the remaining responsibilities. Second, in order to support a credible long-term stewardship program, Congress has expressed a strong interest in learning as much as possible about “portions of sites” where cleanup and stabilization are currently complete or will be complete. Third, during the past 10 years, Congress has appropriated substantial funding (nearly \$60 billion) for DOE to conduct environmental management activities, and DOE needs to demonstrate the degree of success achieved by that funding.

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<sup>3</sup> Unrestricted use generally means that conditions are safe for any exposure scenario, including residential use, subsistence farming, and subsistence fishing. However, it does not necessarily imply cleanup to pristine or background conditions.

## REPORT TO CONGRESS

“The conferees direct the Secretary of Energy to provide to the Armed Services Committees of the Senate and House of Representatives, not later than October 1, 2000, a Report on existing and anticipated long-term environmental stewardship responsibilities for those Department of Energy (DOE) sites or portions of sites for which environmental restoration, waste disposal, and facility stabilization is expected to be completed by the end of calendar year 2006. The Report shall include a description of what sites, whole and geographically distinct locations, as well as specific disposal cells, contained contamination areas, and entombed contaminated facilities that cannot or are not anticipated to be cleaned up to standards allowing for unrestricted use. The Report shall also identify the long-term stewardship responsibilities (for example, longer than 30 years) that would be required at each site, including soil and groundwater monitoring, record-keeping, and containment structure maintenance. In those cases where the Department has a reasonably reliable estimate of annual or long-term costs for stewardship activities, such costs shall be provided.

The Secretary shall attempt to provide sufficient information to ensure confidence in the Department’s commitment to carrying out these long-term stewardship responsibilities and to undertake the necessary management responsibilities, including cost, scope, and schedule.

The conferees recognize that in many cases residual contamination will be left after cleanup or will be contained through disposal, and that such residual contamination and wastes will require long-term stewardship to ensure that human health and the environment are protected.”

(Conference Report on S.1059, National Defense Authorization Act for Fiscal Year 2000, *Congressional Record*, August 5, 1999).

DOE has increasingly focused on the need for long-term stewardship. For example, one of the six Environmental Management principles is the development of an “effective long-term stewardship program - at many sites after cleanup is completed....”<sup>4</sup> Moreover, DOE recognizes the need to ensure that science and technology investments are adequate to address the needs for cost-effective long-term stewardship. DOE has placed a particular emphasis on the need for a better understanding of the existing management roles and responsibilities for long-term stewardship and the relationship between long-term stewardship and science and technology needs.<sup>5,6,7</sup>

This interest and concern about long-term stewardship, both within DOE and externally, has emerged in large part from DOE’s focus on accelerating site cleanup and improving management of the cleanup program. In 1999, DOE published *From Cleanup to Stewardship, A Companion Report to Accelerating Cleanup: Paths to Closure and Background Information to Support the Scoping Process Required for the 1998 PEIS Settlement Study* (also known as the Background Report), that began to address long-term stewardship issues and provides substantial background information and anticipated long-term stewardship activities at DOE

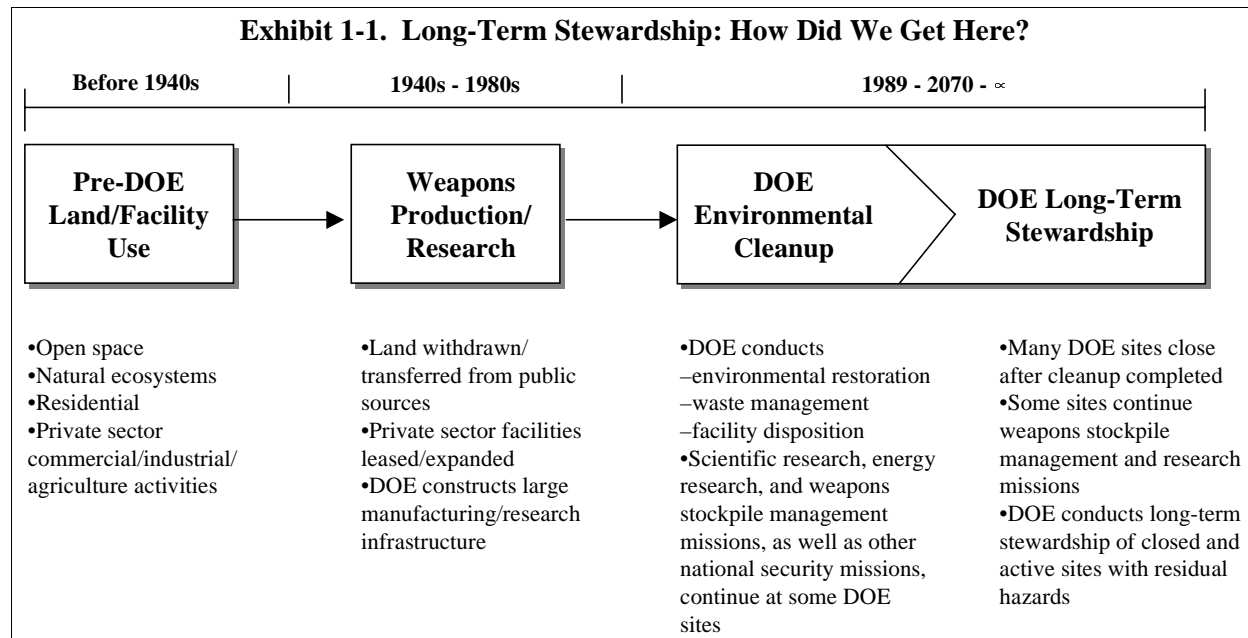
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<sup>4</sup> From the statement of Dr. Carolyn L. Huntoon, Assistant Secretary for Environmental Management, U.S. Department of Energy. “Hearing on the FY 2000 Budget Request Subcommittee on Strategic Committee on Armed Services United States Senate,” February 29, 2000.

<sup>5</sup> *Planning and Implementing RCRA/CERCLA Closure and Post-Closure Care When Waste Remains Onsite*. U.S. Department of Energy, Office of Environmental Policy and Assistance, RCRA/CERCLA Information Brief, DOE/EH-413-9910, October 1999.

<sup>6</sup> *RCRA Closure and Post-Closure Plans*, U.S. Department of Energy, Office of Environmental Guidance, RCRA Information Brief, DOE/EH-231-009-1291, December 1991.

<sup>7</sup> “Science and Technology Needs for Long-Term Stewardship,” Memorandum, December 1999 (<http://its.apps.em.doe.gov/stewlink0.asp>).



sites.<sup>8</sup> An examination of these and other long-term stewardship issues is being prepared by DOE pursuant to a December 1998 lawsuit settlement agreement.<sup>9</sup> The resulting Report, *The Draft National Study on Long-Term Stewardship*, addresses national, programmatic, and cross-cutting issues related to long-term stewardship.<sup>10</sup> These initiatives are described further in Appendix A.

This Report represents the most comprehensive compilation of the Department's anticipated long-term stewardship obligations to date and provides summary information for site-specific, long-term stewardship scope, cost, and schedule. It is based on data submitted by DOE's Field staff and their contractors on current and anticipated long-term stewardship activities. This Report provides a "snapshot" of DOE's current understanding of those activities and highlights areas where significant uncertainties still remain. In addition to responding to the FY 2000 NDAA Congressional request, this Report provides a mechanism for DOE to better communicate future long-term stewardship needs and challenges to stakeholders, as well as to Congress, and provides DOE with the information necessary to better plan for and to manage a long-term stewardship program. This Report does not establish policy regarding the Department's management of long-term stewardship in that it does not prescribe actions or make recommendations. However, it does highlight significant issues that DOE may need to address in the near future.

## 1.2 WHY ADDRESS LONG-TERM STEWARDSHIP NOW?

As the Department accelerates cleanup activities at sites, the need to carry out and prepare for post-cleanup long-term stewardship is also accelerated. Recognizing the need to ensure that human health and the

<sup>8</sup> *From Cleanup to Stewardship, A Companion Report to Accelerating Cleanup: Paths to Closure and Background Information to Support the Scoping Process Required for the 1998 PEIS Settlement Study*, U.S. Department of Energy, Office of Environmental Management, October 1999.

<sup>9</sup> *Natural Resources Defense Council, et al, v. Richardson, et al.*, Civ. No. 97-936 (SS) (D.D.C.), December 12, 1998.

<sup>10</sup> The *National Study on Long-Term Stewardship* was released for public comment in November of 2000.

environment remain protected after cleanup, stabilization, and disposal are completed, the Environmental Management program established the Office of Long-Term Stewardship in 1999, thus emphasizing the Department's commitment to seeking effective long-term stewardship. DOE recognizes the importance of addressing long-term stewardship now in order to improve the management and to estimate the cost of long-term stewardship. These needs are discussed as follows.

#### WHY ADDRESS LONG-TERM STEWARDSHIP NOW?

- To provide for smooth transition from cleanup to long-term stewardship through technical, financial, and managerial planning
- To emphasize that the "cleanup" goal, in many cases, is to reduce and control -- versus eliminate -- risk and cost
- To ensure that Congress, regulators, and other stakeholders have a clear understanding of what the cleanup mission will "produce" and clarify that there is an attainable end-point
- To set realistic expectations and show interim successes and results
- To identify technology research and development needs
- To assure regulators and the public that DOE will not walk away from its enduring obligations

#### *Improving the Management of Long-Term Stewardship*

DOE now considers long-term stewardship to be an integral part of decision-making during the site remediation process. As such, DOE now requires the preparation of a long-term stewardship plan during the early stage of the cleanup process so that the long-term stewardship technical requirements and costs can be considered during the cleanup process.

The importance of integrating long-term stewardship into the cleanup process was emphasized in a recent report by the National Research Council of the National Academy of Science.<sup>11</sup> The Council's report found that the effectiveness of cleanup relies on the effectiveness of three measures: "...contaminant reduction, contaminant isolation and stewardship measures, and that stewardship measures include measures to maintain contaminant isolation and reduction technologies..." A "key point" made in the Council's report is that "stewardship is a pervasive concept and not simply a set of measures to be implemented once remediation is complete." This Report reflects a significant step forward in the Department's understanding of the long-term stewardship implications of its ongoing cleanup process. The Department will continue to increase its knowledge of these long-term implications so that, unlike some decisions made in the past, the Department will consider the long-term consequences of current cleanup activities and other decisions as much as possible.

DOE is beginning to better understand the scope, schedule, and cost of these activities and to better appreciate the inherent uncertainties in planning and estimating long-term stewardship "projects." As DOE moves toward managing long-term stewardship in a project framework, the first step will be to identify projects. In fact, in preparing this Report, a significant effort was required to identify sites and portions of sites where long-term stewardship activities are or will be occurring. Once "projectized," DOE will be better able to develop a scope, cost, and schedule using traditional project management tools. Furthermore, using a project framework, DOE can better document the uncertainties surrounding the long-term stewardship scope, cost, and schedule estimating process. Over time and with more experience, DOE expects that the long-term stewardship cost estimates will become more reliable.

The enduring success of the cleanup activities (e.g., removal and containment) implemented today will depend on the effective long-term stewardship of tomorrow. Maintaining and operating a long-term stewardship program over extended periods of time is an unprecedented task with many unknowns and many

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<sup>11</sup> National Research Council, Board on Radioactive Waste Management, *Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites*, August 2000.

technical and policy uncertainties, as discussed in Chapter 2. These uncertainties impact DOE's overall ability to estimate the scope of the program, as well as its ability to manage the program in the future in the most cost-effective and efficient manner.

Baselines will need to be developed for the long-term stewardship phase. At sites, or portions of sites, where active cleanup activities are complete, the scope, schedule, and cost of long-term stewardship activities can be clearly defined (i.e., stewardship can be defined as a "project"). A transition from having long-term stewardship included within existing baselines as merely a set of "activities" to a more traditional project management framework focused on long-term stewardship activities, where long-term stewardship activities are easily isolated, will allow the Department to integrate long-term stewardship into existing project management systems. While a long-term stewardship baseline will be different than a traditional project baseline, the concepts of project management are still applicable. For example, many long-term stewardship activities will take place in phases (i.e., a groundwater pump and treat system may transition to monitored natural attenuation at an agreed upon point in time or as specified objectives are reached); each phase should be managed as a component in the overall long-term stewardship project baseline. This "projectizing" process will aid DOE in effectively planning, managing, and integrating long-term stewardship activities across the complex.

#### *Estimating the Cost of Long-Term Stewardship*

Estimating the cost of long-term stewardship depends on a number of factors, including the scope and schedule of the activities, as well as uncertainties, such as the reliability of the contaminant isolation and reduction controls, the reliability of the long-term stewardship measures, and a variety of external factors such as climate, human intrusion, and the discovery of additional contamination. Estimating the cost of long-term stewardship requires an understanding of the scope of activities - both technical and institutional - required for each site and for portions of these sites. This understanding of scope and associated costs is increasingly being displayed by Field staff through the development of long-term stewardship plans. Until more detailed long-term stewardship plans are developed and more experience is gained in conducting long-term stewardship activities at various sites, significant uncertainty in DOE's long-term stewardship cost estimates will remain.

Also, as in any planning process, the degree of uncertainty in cost estimates is greater for the long-range out years than for the near-term years. This situation is similar to the challenge posed to the Department in 1994, when the first attempt was made to estimate overall cost and schedule for the Environmental Management (EM) program. Most sites did not at that time develop or maintain project life-cycle plans. Life-cycle planning is now routine for most EM activities, which has allowed the program to move toward developing more rigorous cost estimates of future activities.

No existing institution has yet acquired experience in protecting public health and the environment from hazards for such a long period of time. This lack of experience is a point made in the recent National Research Council report, which includes a quote by the former Director of the Oak Ridge National Laboratory, Alvin Weinberg: "We nuclear people have made a Faustian bargain with society. On the one hand, we offer, in the catalytic nuclear burner, an inexhaustible source of energy... But the price that we demand of society for this magical energy source is both a vigilance and a longevity of our social institutions that we are quite unaccustomed to."

Consequently, the cost estimates in this Report are only as good as the information currently available on the anticipated universe of sites, cleanup remedies, and the anticipated scope of long-term stewardship activities.



More reliable cost estimates for conducting long-term stewardship activities are available at sites where cleanup has been completed, especially for those sites currently managed by DOE's Grand Junction Office, which manages numerous small mill tailings sites where remediation is complete or nearly complete. However, even at the sites that have developed cost estimates, there is considerable uncertainty. For example, the budget for conducting long-term stewardship Field activities is clearly identified, and the Grand Junction Office includes costs for conducting routine monitoring and maintenance. However, it is not clear if the cost estimates include activities such as responding to Freedom of Information Act requests or providing information to future site users.

Site-specific long-term stewardship activities including estimated costs are provided in Volume II, and further discussion of the costs associated with long-term stewardship is provided in Volume I in Chapter 3: Results, as well as Appendices E, F and G of Volume I.

### 1.3 ORGANIZATION OF THIS REPORT

This Report to Congress is presented in two volumes:

- *Volume I, Report to Congress: Long-Term Stewardship Report* contains four chapters that provide a summary-level discussion of the anticipated long-term stewardship activities at DOE sites; establish preliminary site-specific long-term stewardship baselines for cost, scope, and schedule; and discuss key findings and results.
  - Chapter 1 introduces the purpose and provides background
  - Chapter 2 describes the scope and assumptions
  - Chapter 3 presents the results
  - Chapter 4 discusses next steps
- *Volume II, Site Summaries* includes site-specific summaries for the sites where DOE is expected to conduct long-term stewardship, sites where DOE participated in cleanup but is not responsible for long-term stewardship, as well as other sites where DOE may be responsible for long-term stewardship. The site summaries are organized alphabetically by State and include the following for each site: the overall site history, accomplishments to date in conducting environmental remediation activities, the regulatory regime under which long-term stewardship is being or will be conducted, and a summary of long-term stewardship activities that will be required as a result of residual waste or contamination. The summary also provides information on estimated long-term stewardship costs and the basis for the cost estimates (costs were not provided for sites where DOE may not be responsible for long-term stewardship, and 21 FUSRAP sites where the extent of long-term stewardship is yet to be determined). For sites where remediation activities at all site portions are (or will be) completed by 2006, the summary presents an entire site description. For sites where only portions will have active remediation completed or waste stabilized by 2006, the site summaries are broken into portion-by-portion descriptions. Site and portion maps accompany the discussions. A complete list of sites included in Volume II is provided in Appendix B.



**Hull sections of decommissioned nuclear-powered submarines are put in disposal trenches.** The used nuclear fuel is removed from the sections of the submarine hulls that contain nuclear reactors. The radioactively contaminated hull sections with the defueled reactors inside are then transported by barge to Hanford, where they are placed in a trench for burial. *Trench 94, Hanford Site, Washington. July 12, 1994.*



**Submarine Hulls Up Close.** Use of the thick steel submarine hull as a disposal container provides extra isolation between the environment and the low-level waste and hazardous lead that remain after the spent nuclear fuel has been removed. *Trench 94, Hanford Site, Washington. December 20, 1993.*

## Chapter 2

### Scope and Assumptions



## CHAPTER 2: SCOPE AND ASSUMPTIONS

This chapter summarizes the scope of this Report and the assumptions used by DOE in developing the information provided in this Report. In particular, this section discusses:

- the scope of sites for which DOE expects to conduct long-term stewardship activities;
- the specific long-term stewardship activities that DOE anticipates it will perform at sites; and
- the expected timing of long-term stewardship.

Along with each of these discussions, this section also identifies the uncertainties involved and the assumptions used in predicting the scope of sites and activities and the timing of long-term stewardship. The methodology used to collect and analyze site data used for this Report is contained in Appendix C.

### 2.1 SCOPE

This Report presents a comprehensive - albeit not detailed - view of the anticipated scope of DOE's long-term stewardship responsibility. It reflects the results of the first significant data collection effort designed specifically to improve the Department's understanding of the nature and extent of long-term stewardship activities anticipated at DOE sites across the country. This Report was developed to respond to the requirements established by the FY 2000 NDAA, as well as other reasons (discussed in Section 1.1 of this Report), and reflects current planning, the current state of understanding, and information currently available on long-term stewardship.

Consistent with the Congressional request, this Report focuses on sites where remediation for the entire site or portion(s) of a site is anticipated to be complete by 2006 and where DOE is expected to be responsible for long-term stewardship (see Exhibit 2-1). In most cases, this includes sites where cleanup is currently managed by DOE and where DOE has a clear and planned responsibility for long-term stewardship. To respond to broader Congressional interest, and to support DOE program management planning, this Report also includes some additional information about sites where DOE may be responsible for long-term stewardship activities, but the extent of remediation and associated long-term stewardship activities have yet to be determined. Because of the uncertainty about the nature and the extent of the long-term stewardship requirements for these sites, less information is available. Generally, the information in this Report is limited to qualitative information on these sites, (e.g., the names and histories of the sites) consistent with what the Department has already reported in previous documents, such as *Paths to Closure* and *From Cleanup to Stewardship*.<sup>12,13</sup> DOE will develop more detailed information on costs and technical requirements for long-term stewardship at these sites as the cleanup process matures and the nature and the extent of the long-term stewardship needs at these sites are better known.

The scope of long-term stewardship described in previous documents (e.g., *From Cleanup to Stewardship*) was based on the implied site "end states" as described in earlier reports and from data collected to serve other EM initiatives. For example, information was extracted from waste disposition data and planning tools (e.g., disposition maps); the *Baseline Environmental Management Report*, which was designed to estimate the overall cost and schedule for the EM program; and *Paths to Closure*, which was an effort focused on

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<sup>12</sup> *Accelerating Cleanup: Paths to Closure*, DOE/EM-0362, June 1998. "Status Report on Paths to Closure" U.S. Department of Energy Office of Environmental Management, March 2000.

<sup>13</sup> *From Cleanup to Stewardship, A Companion Report to Accelerating Cleanup: Paths to Closure and Background Information to Support the Scoping Process Required for the 1998 PEIS Settlement Study*, U.S. Department of Energy, Office of Environmental Management, October 1999.

### “DOE SITES” VERSUS SITES FOR WHICH DOE MAY HAVE LONG-TERM STEWARDSHIP RESPONSIBILITY

As used in this Report, the term “DOE sites” does not necessarily include the full universe of sites that may become part of DOE’s long-term stewardship responsibilities. Other sites may become DOE’s responsibility for long-term stewardship include the following:

Sites regulated under Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). These are commercial uranium mining and milling sites that contained uranium mill tailings and were in operation at the time of enactment. UMTRCA Title II requires that the host State or the Federal government monitor and maintain all closed Title II mill tailings disposal sites. When a host State declines to become the long-term steward for a mill tailings disposal cell, these responsibilities are assigned to the U.S. Department of Energy (DOE). Once the site is transferred to DOE, DOE becomes a licensee to the NRC under Title 10 of the Code of Federal Regulation Section 40.28, which is the *General License for Custody and Long-Term Care of Uranium of Thorium Byproduct Material Disposal Sites*. Currently two such sites out of a total of 28 are under DOE custody. The balance of the sites may be transferred to DOE over a period of years upon satisfactory completion of site remediation. Therefore, these sites are included in the scope of this Report. In addition to the known 28 sites, other uranium mill tailings sites could be transferred to DOE under the Title II program.

Sites regulated under the Nuclear Waste Policy Act, Section 151(b) and (c). Excluded from this analysis is an uncertain number of low-level radioactive waste sites under Section 151(b) and (c) of the Nuclear Waste Policy Act, as amended (NWSA). Section 151(b) provides DOE the authority to assume title and custody of low-level radioactive waste and the land on which it is disposed, upon request of the owner of the waste site and following termination of the NRC license (subject to certain conditions). DOE’s authority under this section is discretionary, not mandatory, and its current policy is that it does not intend to accept responsibility for these 151(b) sites. For this reason, they are currently not included in this Report. However, it is possible that at some later time such sites may ultimately become the responsibility of DOE and, hence, increase the number of sites that fall within the scope of DOE’s long-term stewardship program.

Section 151(c) of the NWSA provides that if the low-level radioactive waste involved is the result of a licensed activity to recover zirconium, hafnium, and rare earths from source materials, DOE shall assume title and custody of the waste and land, upon request of the owner of the site, when the site has been decontaminated and stabilized in accordance with NRC requirements and has made financial arrangements for long-term maintenance and monitoring. At present, only one such site – the Parkersburg Site in West Virginia – has been transferred to and is being managed by DOE pursuant to Section 151(c), and this site is included in this Report. It is uncertain at this time whether additional such sites will come under DOE’s management.

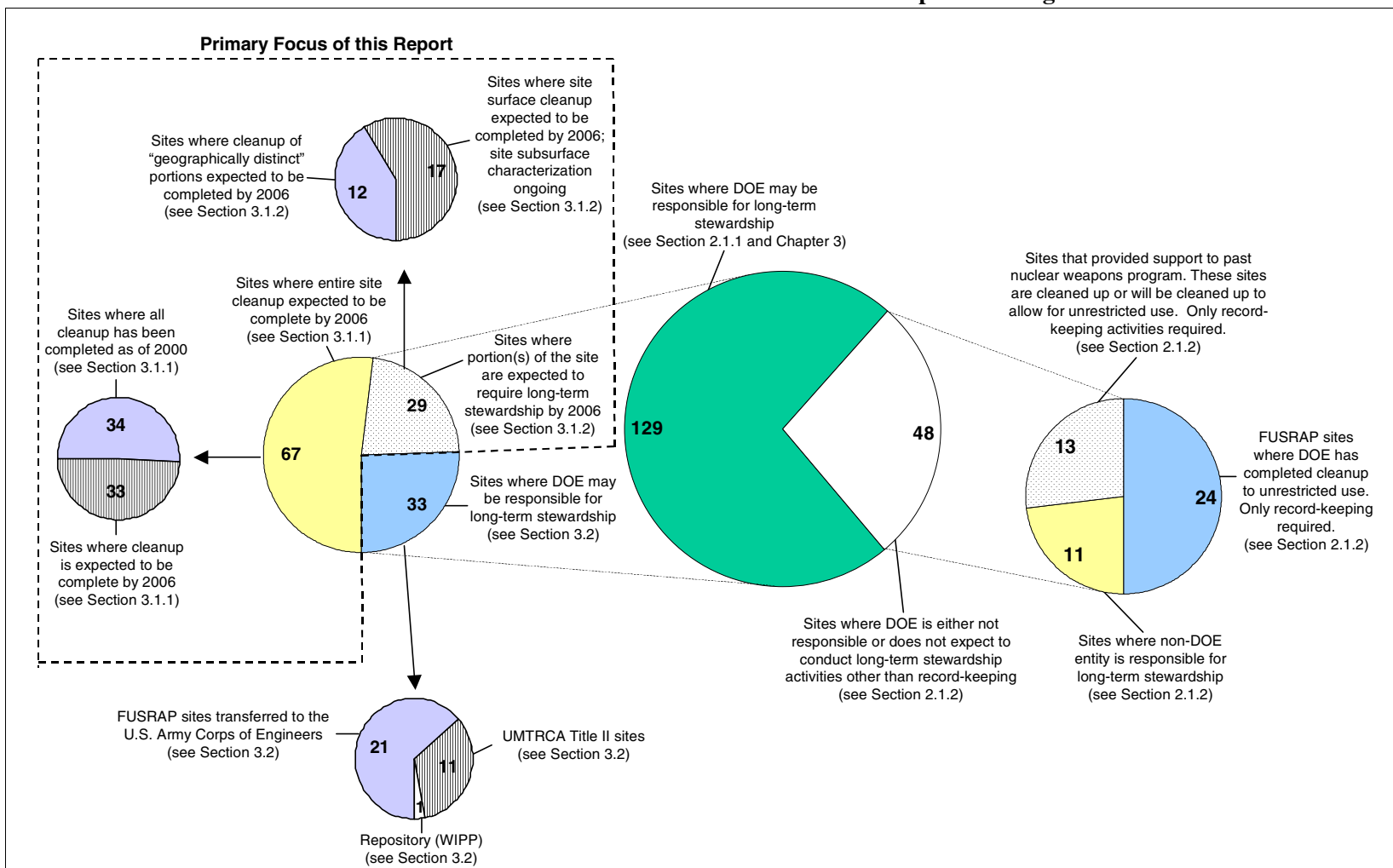
accelerating cleanup, site closure, and project completion.<sup>14</sup> While useful for a first estimate, these various data sources do not necessarily provide adequate detail to capture the long-term stewardship activities. The data collected for this Report allow for examination of long-term stewardship issues with greater granularity, including examining portions of sites versus site-wide analyses; differentiating information by affected media type; and quantifying the volume of contamination and the extent of residual contamination and waste. This Report represents the next step in developing a complete scope and understanding of DOE’s long-term stewardship program. Most Field offices have more detailed information than is summarized in these publicly available documents (some of which is not explicitly identified as “long-term stewardship” information).

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<sup>14</sup> The *Baseline Reports* in 1995 and 1996 were the first post-Cold War effort to describe DOE’s cleanup program and analyze the impacts of various program alternatives. The *Paths to Closure* reports in 1998, 1999, and 2000 sought not only to describe the EM program, but to identify ways to accelerate the cleanup, site closure and project completion process and reduce overall costs. Data from both reports were used to develop the initial estimates of the scope of long-term stewardship.



**Exhibit 2-1. Total Number of Sites Considered for this Report to Congress<sup>15</sup>**

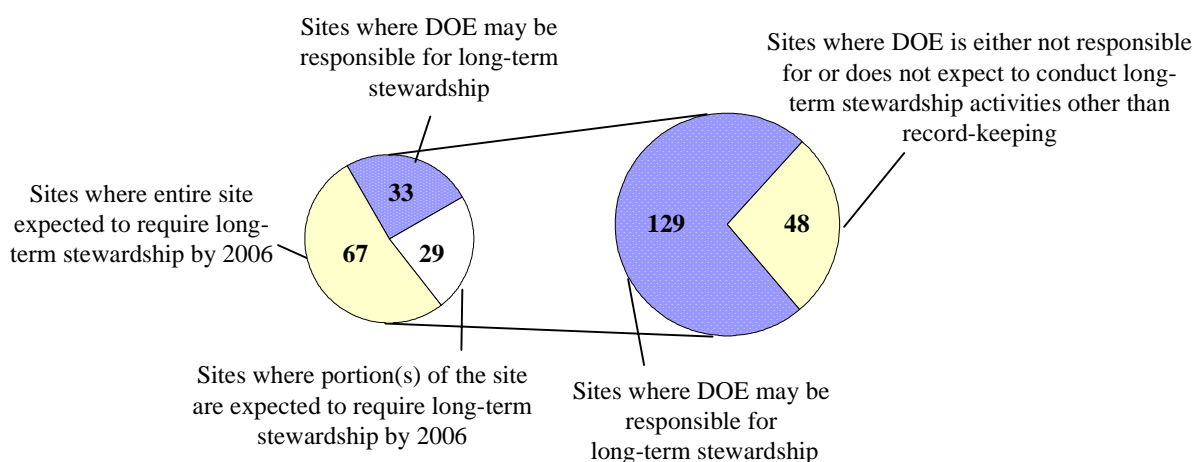


<sup>15</sup> This report does not include sites managed by the Naval Nuclear Propulsion Program -- a joint DOE/U.S. Navy program. The sites included in this program are the Knolls Atomic Power Laboratory near Schenectady, NY; Kesselring Site, located about 25 miles north of the Knolls Atomic Power Laboratory near West Milton/Saratoga Springs, NY; the Bettis Laboratory, near Pittsburgh, PA; the Windsor Site of the Knolls Atomic Power Laboratory in Windsor, CT; and the Naval Reactors Facility located at the Idaho National Engineering and Environmental Laboratory.

### 2.1.1 DOE Expects to Conduct Long-Term Stewardship Activities at up to 129 Sites<sup>16</sup>

Based on data submitted for this Report and the methodology used for the development of this Report (see Appendix C), DOE is conducting or expects to conduct long-term stewardship activities at up to 129 sites (see Exhibit 2-2). By 2006, DOE expects to conduct long-term stewardship activities at 96 of these sites. The extent of long-term stewardship activities at these 96 sites, depend on the nature of remaining residual contaminants. DOE may be responsible for long-term stewardship activities at an additional 33 sites post 2006; however, the extent of remediation activities and the extent of long-term stewardship activities, if any, for many of these sites are not known at this time.

**Exhibit 2-2. DOE Expects to Conduct Long-Term Stewardship Activities at up to 129 Sites**

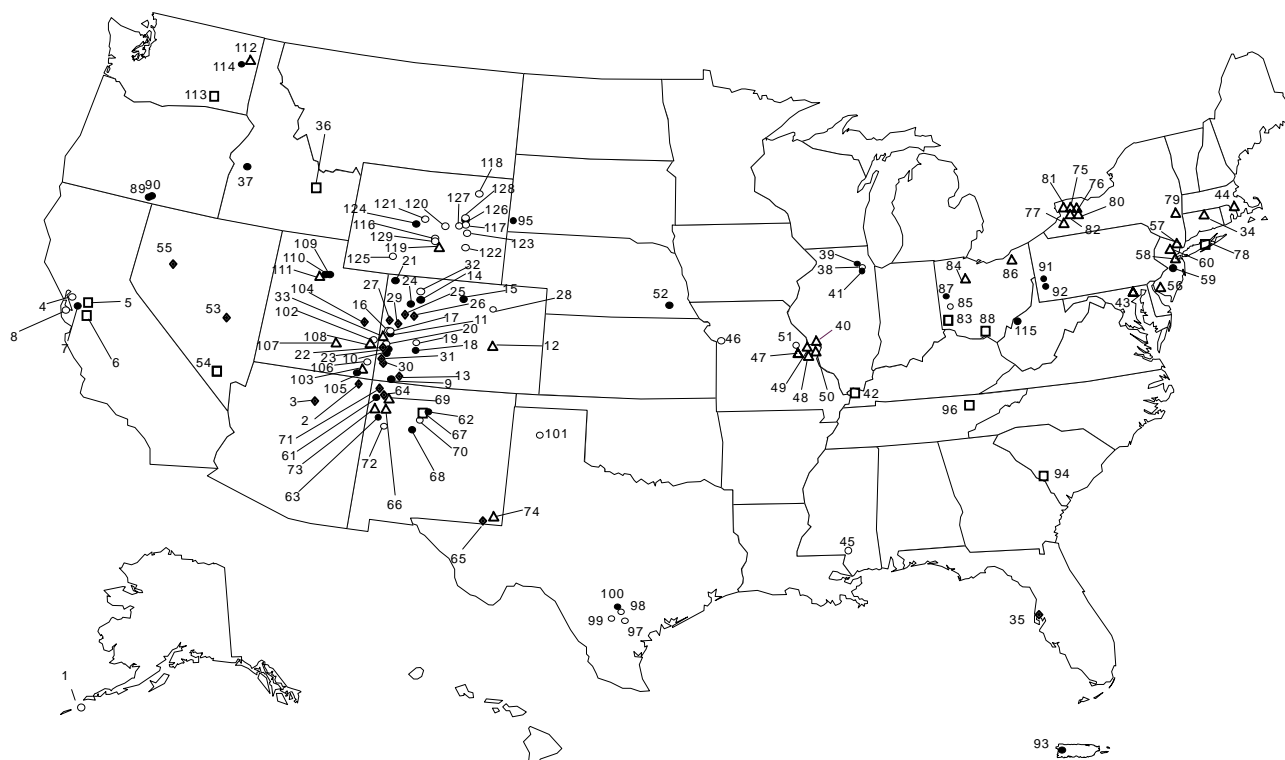


The specific locations and names of the 129 sites are provided in Exhibit 2-3 and Table 2-1. These sites can be described as follows:

- Remediation activities are expected to be entirely completed for 67 sites by 2006. At these sites, the only remaining environmental management commitment will be performing long-term stewardship activities. Remediation activities for 34 of the 67 sites are already complete as of 2000 (see Section 3.1.1).
- At 29 sites, DOE is either conducting or expects to conduct long-term stewardship activities at portions of the sites where remediation activities have been or will be completed by 2006. At 12 of the 29 sites, DOE anticipates having completed remediation activities at geographically distinct portions of the sites by 2006. At the remaining 17 sites, DOE anticipates completing surface remediation work by 2006 but will have ongoing responsibility for subsurface characterization and remediation beyond 2006 (see Section 3.1.2).
- DOE may be responsible for long-term stewardship activities at as many as 33 additional sites (see Section 3.2), but the extent of remediation and associated long-term stewardship activities have yet to be determined.

<sup>16</sup> The 129 sites include 33 sites where DOE may be responsible for conducting long-term stewardship activities. Twenty-one of the 33 sites are FUSRAP sites where responsibility was transferred to the U.S. Army Corps of Engineers (Corps) in accordance with the Energy and Water Development Appropriations Act for FY 1998. At these sites, the Corps is responsible for remediation and DOE is responsible for long-term stewardship activities, if necessary. The cleanup decisions for these sites are not yet final and, therefore, the extent of long-term stewardship required for these sites, if any, is not yet known.

**Exhibit 2-3. Map of 129 Sites that May Require Long-Term Stewardship (see Table 2-1 for names of sites)**



- |   |  |   |  |
|---|--|---|--|
| <ul style="list-style-type: none"> <li>● 34 sites where cleanup has been completed and DOE is conducting long-term stewardship activities as of 2000</li> </ul>   | <ul style="list-style-type: none"> <li>○ 33 sites where cleanup is expected to be completed and DOE will conduct long-term stewardship activities by 2006</li> </ul> | <ul style="list-style-type: none"> <li>29 sites where portion(s) of the site are expected to require long-term stewardship by 2006                             <ul style="list-style-type: none"> <li>□ 12 sites with geographically distinct portions requiring long-term stewardship by 2006</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>▲ 33 sites where DOE may be responsible for long-term stewardship, if long-term stewardship activities are necessary</li> </ul> |
| <ul style="list-style-type: none"> <li>◆ 17 sites where surface cleanup is completed by 2006 and will require long-term stewardship but subsurface characterization and remediation activities will be on-going after 2006</li> </ul> |  |   |  |

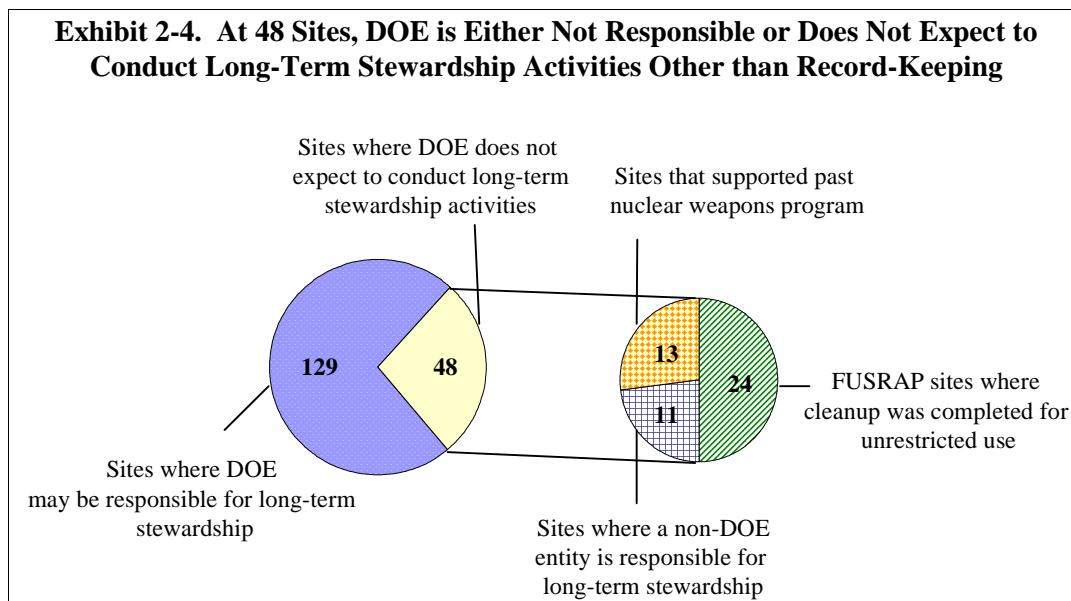
**Table 2-1. 129 Sites That May Require Long-Term Stewardship** (see Exhibit 2-3 for locations)

No.	State	Site	No.	State	Site	No.	State	Site
1	AK	Amchitka Island	44	MA	Shpack Landfill	87	OH	Piqua Nuclear Power Facility
2	AZ	Monument Valley Site	45	MS	Salmon Site	88		Portsmouth Gaseous Diffusion Plant
3		Tuba City Site	46	MO	Kansas City Plant	89	OR	Lakeview Mill
4	CA	Lawrence Berkeley National Laboratory	47		Latty Avenue Properties	90		Lakeview Site
5		Lawrence Livermore National Laboratory - Livermore	48		St. Louis Airport Site	91	PA	Burrell Site
6		Lawrence Livermore National Laboratory - Site 300	49		St. Louis Airport Site Vicinity Properties	92		Canonsburg Site
7		Sandia National Laboratories - CA	50		St. Louis Downtown Site	93	PR	Center for Energy and Environmental Research
8		Stanford Linear Accelerator	51		Weldon Spring Site	94	SC	Savannah River Site
9	CO	Bodo Canyon Cell	52	NE	Hallam Nuclear Power Facility	95	SD	Edgemont Site
10		Burro Canyon Disposal Cell	53	NV	Central Nevada Test Area	96	TN	Oak Ridge Reservation
11		Cheney Disposal Cell	54		Nevada Test Site	97	TX	(Chevron) Panna Maria Site
12		(Cotter) Cañon City Site	55		Project Shoal	98		(Conoco) Conquista Site
13		Durango Mill	56	NJ	DuPont & Company	99		(Exxon) Ray Point Site
14		Estes Gulch Disposal Cell	57		Maywood Chemical Works	100		Falls City Site
15		Fort St. Vrain Independent Spent Fuel Storage Facility	58		Middlesex Sampling Plant	101		Pantex Plant
16		Grand Junction Mill 1	59		Princeton Plasma Physics Laboratory	102	UT	(Atlas) Moab Mill
17		Grand Junction Mill 2	60		Wayne Site	103		(EFN) White Mesa Site
18		Gunnison Disposal Cell	61	NM	Ambrosia Lake	104		Green River Site
19		Gunnison Mill	62		Bayo Canyon	105		Mexican Hat Site
20		(HECLA) Durita Site	63		Bluewater Site	106		Monticello Mill Site and Vicinity Properties
21		Maybell Mill Site	64		Gasbuggy Site	107		(Plateau) Shootaring Canyon Site
22		Naturita Mill	65		Gnome-Coach	108		(Rio Algom) Lisbon Valley Site
23		Naturita Site	66		(Homestake) Grants Site	109		Salt Lake City Mill
24		Naval Oil Shale Reserves Site	67		Los Alamos National Laboratory	110		South Clive Disposal Cell
25		Rifle (New) Mill	68		Lovelace Respiratory Research Institute	111		11e.(2) Disposal Site
26		Rifle (Old) Mill	69		(Quivira) Ambrosia Lake Site 2	112	WA	(Dawn) Ford Site
27		Rio Blanco	70		Sandia National Laboratories - NM	113		Hanford Site
28		Rocky Flats Environmental Technology Site	71		Shiprock Site	114		(WNI) Sherwood Site
29		Rulison	72		(SOHIO) LBAR Site	115	WV	Parkersburg Site
30		Slick Rock (North Continent) Mill 1	73		(UNC) Church Rock Site	116	WY	(ANC) Gas Hills Site
31		Slick Rock (Union Carbide) Mill 2	74		Waste Isolation Pilot Plant	117		(Exxon) Highlands Site
32		(UMETCO) Maybell Site 2	75	NY	Ashland Oil #1	118		Hoe Creek Underground Coal Gasification Site
33		(UMETCO) Uravan Site	76		Ashland Oil #2	119		(Kennecott) Sweetwater Site
34	CT	CE	77		Bliss and Laughlin Steel	120		Naval Petroleum Reserve No. 3 Landfill/Landfarm
35	FL	Pinellas STAR Center	78		Brookhaven National Laboratory	121		(Pathfinder) Lucky Mc Site
36	ID	Idaho National Engineering and Environmental Lab	79		Colonie	122		(Pathfinder) Shirley Basin Site 2
37		Lowman Site	80		Linde Air Products	123		(Petrochemicals) Shirley Basin Site 1
38	IL	Argonne National Laboratory East	81		Niagara Falls Storage Site	124		Riverton Site
39		Fermi National Accelerator Laboratory	82		Seaway Industrial Park	125		Rock Springs Oil Shale Retort Site
40		Madison	83	OH	Fernald Environmental Management Project	126		Spook Site
41		Palos Forest (Site A/Plot M) Preserve	84		Luckey	127		(UMETCO) Gas Hills Site
42	KY	Paducah Gaseous Diffusion Plant	85		Miamisburg Environmental Management Project	128		(Union Pacific) Bear Creek Site
43	MD	W. R. Grace and Company	86		Painesville	129		(WNI) Split Rock Site

### 2.1.2 48 Sites Where DOE Is Either Not Responsible or Does Not Expect to Conduct Long-Term Stewardship Activities Other than Record-Keeping

DOE identified 48 sites, noted in previous DOE documents, where it is either not responsible or does not expect to conduct long-term stewardship activities other than record-keeping. The categories of these sites are discussed below and illustrated in Exhibit 2-4. Generally, there are two reasons why DOE does not expect to be responsible for long-term stewardship activities at sites where DOE has been involved in the cleanup:

- Legal or other agreements identify an entity other than DOE as being responsible for long-term stewardship, if needed.
- Some sites have been or will be cleaned up to standards allowing for unrestricted use, requiring no long-term stewardship other than record-keeping activities by DOE.



#### *Sites Where a Non-DOE Entity is Responsible for Long-Term Stewardship*

There are 11 sites where, upon completion of cleanup, DOE does not currently anticipate being responsible for long-term stewardship activities. At these sites, DOE is responsible for site cleanup activities but is not the owner of the sites and not expected to be responsible for long-term stewardship. In the case of the West Valley Demonstration Project in New York, the nature of and responsibility for long-term stewardship activities are currently being negotiated with the State of New York and, therefore, are yet to be determined. DOE does not own this site, but is responsible for most of the site's cleanup activities.

#### **11 SITES WHERE NON-DOE ENTITY IS RESPONSIBLE FOR LONG-TERM STEWARDSHIP**

California	Energy Technology Engineering Center General Atomics General Electric Vallecitos Nuclear Center Laboratory for Energy Related Health Research
Kentucky	Maxey Flats Disposal Site
Missouri	Westlake Disposal Site
New Mexico	South Valley Superfund Site
New York	West Valley Demonstration Project*
Ohio	Ashtabula Environmental Management Project Battelle Columbus - King Avenue Site Battelle Columbus - West Jefferson Site

\* DOE's long-term stewardship responsibility, if any, is currently undetermined.

*Sites Which Have Been or Will Be Cleaned to Unrestricted Use Levels, Requiring No Long-Term Stewardship Activities Other than Record-Keeping*

There are 37 sites where DOE has completed or has plans to complete cleanup to levels allowing for unrestricted use and where long-term stewardship activities are expected to be limited to record-keeping only.<sup>17</sup> These sites include

- 24 Formerly Utilized Sites Remedial Action Program (FUSRAP) sites, and
- 13 sites that supported past nuclear weapons or power programs.

The 24 FUSRAP sites were cleaned up to unrestricted use by DOE during the period prior to 1997, when DOE was still responsible for the FUSRAP program. These sites were contaminated during the 1940s and 1950s as a result of researching, developing, processing, and producing uranium and thorium and storing processing residues. Cleanup work at the sites began in the late 1970s. DOE completed cleanup at these sites allowing for unrestricted use. DOE's only remaining responsibility is to maintain records of the completed cleanup. For example, one such site is the Aliquippa Forge site located just west of the Ohio River in Pennsylvania. Completion of remediation of low-level radioactive waste in 1994 included building decontamination and excavation of contaminated soil and concrete. The current site owner is the Beaver County Corporation for Economic Development. DOE's only remaining role is maintaining records of the cleanup.

<b>24 FUSRAP SITES WHERE DOE HAS COMPLETED CLEANUP ALLOWING FOR UNRESTRICTED USE</b>			
California	University of California	New York	Baker and Williams Warehouses
Connecticut	Seymour Specialty Wire		Niagara Falls Storage Site Vicinity
Illinois	Granite City Steel		Properties
	National Guard Armory	Ohio	Alba Craft
	University of Chicago		Associate Aircraft
Massachusetts	Chapman Valve		B&T Metals
	Ventron		Baker Brothers
Michigan	General Motors		Herring-Hall Marvin Safe Co.
New Jersey	Kellex/Pierpont	Oregon	Albany Research Center
	Middlesex Municipal Landfill	Pennsylvania	Aliquippa Forge
	New Brunswick Site		C.H. Schnoor, PA
New Mexico	Acid/Pueblo Canyons	Tennessee	Elza Gate
	Chupadera Mesa		

The 13 sites that supported past nuclear weapons or power programs include various former test sites and research facilities. At these sites, DOE has completed or expects to complete cleanup to levels allowing for unrestricted use. Now, only record-keeping activities by DOE are required. For instance, DOE anticipates completing all remediation activities by 2006 at the Ames Laboratory in Iowa. In 1998, the Iowa Department of Public Health approved the site for unrestricted use; however, DOE will continue to perform groundwater monitoring through 2002 and other actions through 2006. Consequently, DOE anticipates no long-term stewardship activities, beyond record-keeping activities, to be required.

<sup>17</sup> Although record-keeping is part of long-term stewardship, for the purpose of this Report, record-keeping is not considered active long-term stewardship.



### 13 SITES THAT SUPPORTED PAST NUCLEAR WEAPONS OR POWER PROGRAMS

Alaska	Project Chariot	New Mexico	Holloman Air Force base
California	Geothermal Test Facility		Pagano Salvage Yard
	Oxnard Facility	New York	Separation Process Research Unit
	Salton Sea Test Base	North Dakota	Belfield <sup>a</sup>
Florida	Peak Oil PRP Participation		Bowman <sup>a</sup>
Hawaii	Kauai Test Facility	Pennsylvania	Shippingport <sup>b</sup>
Iowa	Ames Laboratory		

<sup>a</sup> Any long-term responsibility for these sites resides with the State of North Dakota.

<sup>b</sup> Supported commercial nuclear power demonstration projects.

### 2.1.3 Uncertainties in Estimating the Number of Sites

The estimated number of sites at which DOE expects to perform long-term stewardship activities has remained fairly constant since 1995, when DOE first began conducting analyses of the potential scope of long-term stewardship. However, there are several factors that could increase the number of sites significantly.

As discussed earlier, the scope of this Report includes only sites for which DOE clearly has responsibility for any required long-term stewardship activities currently or in the future. This includes 96 sites where DOE expects to conduct long-term stewardship for either the entire site or portion(s) of the site.

However, DOE is also responsible for long-term stewardship at sites categorized under the Formerly Utilized Sites Remedial Action Program (FUSRAP) and the Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II, and may be responsible for sites under NWPA Section 151, but the timing and extent of DOE's long-term stewardship obligations at these sites still remains uncertain at this time. This is further elaborated below.

- FUSRAP Sites.** The FY 1998 Energy and Water Appropriations Act transferred responsibility for cleanup of 21 sites being managed as part of FUSRAP from DOE to the U.S. Army Corps of Engineers (Corps) (see Section 3.2). Subsequently, DOE and the Corps completed a Memorandum of Understanding (MOU) that requires that DOE take responsibility for sites after cleanup (beginning two years following "closure" of the cleanup project) to conduct required long-term stewardship activities, if any. The extent of DOE's long-term stewardship responsibilities will depend on the final cleanup decisions made for each site and are uncertain at this point.
- UMTRCA Title II Sites.** A number of privately owned sites that were contaminated with uranium mill tailings resulting from the processing of uranium for sale to the Federal government and to private clients. Upon completion of remediation work, DOE will maintain records and conduct maintenance and monitoring to ensure continued appropriate land use. The Department began a program in September 2000 to develop a database of sites that will improve the efficiency with which these sites are tracked.<sup>18</sup> Similar to the FUSRAP sites, the extent of DOE's long-term stewardship responsibility will depend on the final cleanup decisions made for each UMTRCA Title II site.

<sup>18</sup> In response to a question, "The government never has released any sort of comprehensive list of all the private sites. Would you consider compiling a registry?" Secretary of Energy, Bill Richardson, stated, "I would be receptive to such an idea. We've already started to develop databases that can be shared with the public. I believe it's important that we be open with the public and our workers, and we should do a full accounting" (USA Today on September 6, 2000).

- **NWPA Section 151 Sites.** Another source of potential long-term stewardship liability for DOE arises from Sections 151(b) and (c) of the NWPA. Section 151(b) provides “authority,” but not a requirement, for DOE to take responsibility for long-term stewardship at low-level waste disposal sites after cleanup is complete (provided certain conditions are met, e.g., financial arrangements and compliance with NRC closure, decommissioning, and decontamination requirements). DOE is seeking to avoid or minimize any liability to the Government from additional facilities and to ensure, pursuant to the law, that any facilities transferred to DOE for long-term stewardship occur only at no cost to the Government. It’s current policy is to not seek responsibility for long-term stewardship of these sites. However, DOE understands that there may arise circumstances under which DOE may need to accept such responsibility. For example, if a facility owner lacks the funds to conduct long-term stewardship (i.e., as a result of bankruptcy), there might be only a few options for ensuring that long-term stewardship activities are in place to protect health and the environment. It is possible that the owner would have established and have available funding through a surety bond. It is also possible that the State where the site is located could take responsibility for long-term stewardship. In any case, it is too uncertain at this time to predict whether such sites would come under DOE’s responsibility for long-term stewardship. (Before accepting any such responsibility, DOE would need to understand the nature and extent of the potential liabilities. This research and analysis could help provide an informed basis from which to discuss any proposed transfer.)

Section 151(c) of the NWPA provides that if the low-level radioactive waste involved is the result of a licensed activity to recover zirconium, hafnium, and rare earths from source materials, DOE shall assume title and custody of the waste and land, upon request of the owner of the site, when the site has been decontaminated and stabilized in accordance with NRC requirements and has made financial arrangements for long-term maintenance and monitoring. At present, only one such site – the Parkersburg Site in West Virginia – has been transferred to and is being managed by DOE pursuant to Section 151(c), and this site is included in this Report. It is uncertain at this time whether additional such sites will come under DOE’s management.

The number of sites for which DOE has long-term stewardship responsibility may also decrease over time, depending on a number of factors. A change in law could transfer long-term responsibility of some sites to another governmental, Tribal, or private entity. New developments in science and technology could provide solutions to contaminated sites currently included in the scope of long-term stewardship because they are technically or economically infeasible to clean up. At some sites, the radiological contaminants have short half-lives, so that in a matter of decades or centuries the hazard may no longer exist. Many varied situations like these could affect DOE’s responsibilities over time.

#### **2.1.4 Activities Required for Long-Term Stewardship**

For sites to achieve closure and begin the phase of long-term stewardship, the first critical activity is to develop detailed long-term stewardship plans. Detailed planning early on, which includes clearly defining the end state, will ensure that all decision-makers and stakeholders understand the final cleanup objectives (e.g., the end state, including cleanup levels and land use), how those objectives will be achieved (e.g., the remedies selected), and the requirements for maintaining the site after remediation activities are completed (e.g., long-term stewardship requirements and their implications for future land use). Sites will need to identify and document the scope, schedule, costs, and uncertainties associated with long-term stewardship activities in sufficient detail to ensure effective and efficient management of these activities, including

appropriate exit strategies.<sup>19</sup> Documentation may be in a variety of forms. For example, for sites where the only ongoing activities will be long-term stewardship, this information can be documented in a long-term stewardship plan. (The Grand Junction Office already requires long-term stewardship plans for all sites managed under its long-term stewardship program.<sup>20</sup>) For other sites, such as sites with ongoing research or defense missions, long-term stewardship activities may be included in site-wide management plans, Land Use Control and Assurance Plans (LUCAPs), or other comparable documents that would provide sufficient detail (e.g., technical scope, uncertainties, activities, and cost) needed to effectively manage long-term stewardship at these sites.<sup>21</sup>

Long-term stewardship involves a wide variety of activities, depending on the site conditions and/or the residual hazards. Some long-term stewardship activities have been mandated by regulation, compliance agreements, DOE Orders, or site-specific documents, while others are yet to be defined. Although statutory and regulatory requirements provide guidelines for long-term stewardship, existing requirements do not clearly delineate the measures needed in the future for long-term stewardship; nor do they ensure the development of effective implementation strategies.

Long-term stewardship activities currently range from record-keeping, surveillance, monitoring, and maintenance at sites with residual contamination posing hazards of little concern, to possibly maintaining permanent access restrictions at sites having hazards of greater concern. They are generally described as the activities necessary to maintain either institutional controls or engineered controls (e.g., contaminant reduction and isolation measures) in place at the sites. Institutional controls are designed to control future land or resource use of a site with residual contamination by limiting land development or restricting public access to the resources. Institutional controls include physical systems (e.g., fences or other barriers), governmental controls (e.g., ordinances and building permit requirements), and proprietary controls (e.g., deed restrictions and easements). Engineered controls are barriers constructed to prevent contaminant migration or to prevent intrusion to an otherwise restricted area. Examples of engineered controls include caps and liners, leachate collection systems, and monitoring and containment systems.<sup>22</sup>

Examples of long-term stewardship activities include monitoring for potential contaminant migration and assessing, on an ongoing basis, the effectiveness of existing remedies (e.g., disposal cells, physical access restrictions, permits, and other legal or institutional controls). Table 2-2 describes examples of long-term stewardship activities by media that will be conducted at DOE sites. Further discussion of long-term stewardship activities is included in Chapter 3 of this Report. Site-specific activities are described in Volume II.

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<sup>19</sup> *Developing Exit Strategy for Environmental Restoration Projects*. DOE Office of Environmental Management, March 2000.

<sup>20</sup> An example of a long-term surveillance plan for a site transferred to the Grand Junction Office for long-term stewardship is available at <http://www.doegjpo.com/programs/ltsm>.

<sup>21</sup> Region IV Federal Facilities Branch: (Memorandum from Jon D. Johnstown, Chief) "Assuming Land Use Controls at Federal Facilities." U.S. EPA, Region IV. 4WD-FFB. April 13, 1998. See <http://www.epa.gov/region04/waste/fedfac/landusea.htm>.

<sup>22</sup> See *Institutional Controls in RCRA & CERCLA Response Actions*. U.S. Department of Energy, Office of Environmental Health. DOE/EH-413-0004. August 2000.

Table 2-2. Examples of Long-Term Stewardship Activities by Media

<i>Media Subject to Long-Term Stewardship Requirements</i>	<i>Examples of Long-Term Stewardship Activities</i>
<b>Groundwater:</b> All contaminated groundwater that cannot or has not been remediated to levels appropriate for unrestricted use or met alternate regulatory levels	<ul style="list-style-type: none"> <li>• Verification and/or performance monitoring</li> <li>• Use restrictions, access controls (site comprehensive land use plan)</li> <li>• Five-year (or comparable) review requirements</li> <li>• Resource management to minimize potential for exposure</li> </ul>
<b>Soil:</b> All surface and subsurface soil where residual contamination exists or where wastes remain under engineered, vegetative, or other caps	<ul style="list-style-type: none"> <li>• Institutional controls to limit direct contact or food chain exposure</li> <li>• Maintaining engineered, asphalt, or clean soil caps</li> <li>• Permit controls, use restrictions, markers (site comprehensive land use plan)</li> <li>• Five-year (or comparable) remedy review requirements</li> </ul>
<b>Engineered Units:</b> All land-based waste disposal units with engineered controls	<ul style="list-style-type: none"> <li>• Monitoring and inspections, per agreements, orders, or permits</li> <li>• Institutional controls, including restricted land use</li> <li>• Maintenance, including repairing caps</li> <li>• Five-year (or comparable) review requirements</li> <li>• Land and resource planning to minimize potential for exposure (site comprehensive land use plans)</li> </ul>
<b>Facilities:</b> Buildings and other structures that are no longer in use, are contaminated, or for which future plans call for maintaining the structure with contamination in place	<ul style="list-style-type: none"> <li>• Monitoring, inspections, and safeguard and security measures</li> <li>• Access restrictions</li> <li>• Five-year (or comparable) review requirements</li> <li>• Site reuse or redevelopment controls to minimize the potential for exposure (site comprehensive land use plan)</li> </ul>
<b>Surface Water/Sediments:</b> All surface water and sediments that cannot or have not been remediated to levels appropriate for unrestricted use	<ul style="list-style-type: none"> <li>• Monitoring, signage, land use restrictions</li> <li>• Five-year review</li> </ul>

### 2.1.5 Uncertainties in Estimating the Scope of Long-Term Stewardship Activities

A key reason for uncertainties in estimating the scope and the associated schedule of long-term stewardship activities is the quality and completeness of available data. Uncertainties also reflect the current status of ongoing activities. Site personnel are currently characterizing the sites, assessing risk, and developing paths forward that will ultimately lead to long-term stewardship activities. The data collected for this Report represent, at best, a preliminary understanding of the nature of the challenge ahead. While data collected during this effort are much improved over the data used to develop the *Background Report*, the fact remains that there is a clear need to better understand the scope, schedule, and cost associated with managing long-term stewardship, as well as the impacts of uncertainties on the Department's ability to manage these activities.

The long-term stewardship plans required by the Long-Term Surveillance Program of DOE's Grand Junction Office include specific information on the location and the type of remaining hazards, required long-term monitoring activities, and detailed cost estimates for these activities. Most sites do not have staff dedicated to long-term stewardship planning. Therefore, the data received are often only estimates, may conflict with other data collection efforts, and may not accurately reflect the long-term responsibilities. Increased

understanding will allow the Department to better manage site-specific, long-term stewardship activities, better identify and plan for the technical uncertainties, and better direct the science and technology program to eventually address some of the residual contamination.

Many sites, such as Hanford, the Savannah River Site, and the Oak Ridge Reservation, have complex contamination and remediation challenges ahead. There are areas of multiple, co-mingled contaminants in groundwater plumes, and the extent of subsurface contamination remains unknown. These sites also have technically challenging problems in implementing an end state for the former production reactors and the processing canyons. Many remediation decisions are awaiting results of site characterization and investigation efforts. Until these decisions are made, significant uncertainty remains as to what the long-term obligations for the Department will be. While it is clear that long-term stewardship will be required at these sites because of existing disposal cells and some other known conditions (e.g., groundwater contamination that will be monitored and contained rather than remediated), the list of activities and associated costs to manage these activities in the future remains uncertain.

At other sites, where cleanup decisions have been made, a different type of uncertainty exists. Decisions have been made based on criteria identified in existing cleanup programs (e.g., RCRA, CERCLA) that include such factors as protectiveness of human health and the environment, long and short-term effectiveness, implementability, and overall community acceptance. However, these decisions are based on current regulatory requirements, an understanding of the overall site conditions, and assumed future land use, all of which may change at some point in the future.

There may also be a significant amount of additional record-keeping that is not currently included within the scope of this analysis. At sites where cleanup has been completed to levels allowing for unrestricted use, some record-keeping effort will still be required. The record-keeping will be needed because prospective site users may need to learn about the historic site use and known or suspected contamination, and whether the site was cleaned up. In this case, a record of the cleanup is necessary to explain whether any contamination was found and, if so, whether this historic contamination was removed, and the levels to which the contamination was cleaned up. By having ready access to these records, future site users can avoid potentially expensive and potentially dangerous site sampling to determine what the records could more readily show: whether the site has been “cleaned up” and to what level. It is also important to maintain records of previous cleanup if unknown contamination or other hazards are discovered in the future. Maintenance of records about the levels of residual contamination remaining for each site and portions of a site where cleanup has occurred is necessary, even if those levels are considered “safe for unrestricted use” by current standards. However, these standards could change and become more strict in the future. Maintaining these records does not necessarily imply that the Department of Energy agrees to undertake additional cleanup if standards become more restrictive.

The level of cleanup is based on the expected future land use. If the land use changes, or the underlying exposure standards on which those land uses were based change, then reliable records will be required to decide if additional cleanup or other protections are needed. The Department has indicated to the State and Tribal Government Working Group that, if a site has been remediated to levels appropriate for the specified land use, and communities decide that they desire further cleanup to allow for less restrictive land uses, then the cost of such additional cleanup should not be borne by the Department of Energy.<sup>23</sup>

Technical uncertainties also make estimating the scope of long-term stewardship very difficult. These

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<sup>23</sup> Letter from James Owendoff to Armand Minthorn and Tom Winston, Co-Convenors of the State and Tribal Government Working Group (STGWG) Executive Committee on Closure for Seventh Generation, May 24, 1999 (page 1).

uncertainties include the nature of the hazards remaining onsite and the effectiveness of monitoring and maintenance of barriers and institutional controls. Other unknowns include the availability of adequate technologies in the future to address residual contaminants, the future development of better remedial and surveillance technologies, and the long-term management of data. These uncertainties should be included in site long-term stewardship plans to assist future stewards in addressing issues at the sites, should they arise. Examples of technical uncertainties associated with long-term stewardship are presented in Table 2-3.

**Table 2-3. Examples of Technical Uncertainties by Media**

<i>Media</i>	<i>Technical Uncertainties</i>
<b>Groundwater</b>	<ul style="list-style-type: none"> <li>• What is the likelihood that residual contaminants will move toward or degrade a current or potential potable water source?</li> <li>• Are dense non-aqueous phase liquids (DNAPLs) or long-lived radionuclides present in concentrations and/or locations different than those identified?</li> <li>• Will treatment, containment, and monitoring programs remain effective and protective?</li> <li>• Will ambient conditions change significantly enough to diminish the effectiveness of the selected remedy (e.g., monitored natural attenuation) or allow resuspension of stabilized contaminants in sediments?</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• What is the likelihood of future contaminants migration if ambient conditions change?</li> <li>• How will changes in land use affect the barriers in place to prevent contaminant migration and potential exposure?</li> <li>• What is the likelihood of cap failure sooner than anticipated?</li> <li>• What is the effect of contaminant degradation on remedy components (e.g., cap, vegetation)?</li> </ul>
<b>Engineered Units</b>	<ul style="list-style-type: none"> <li>• What is the effect of contaminant degradation on remedy components (e.g., liners, leachate collection systems, caps)?</li> <li>• At what point in time will the remedy require significant repair or reconstruction?</li> <li>• Is the monitoring system robust enough to provide early detection of remedy failure?</li> </ul>
<b>Facilities</b>	<ul style="list-style-type: none"> <li>• Will current controls remain adequate to maintain protection of facilities?</li> <li>• How will fixed residual contamination remain adequately controlled given current facility uses?</li> </ul>
<b>Surface Water/ Sediments</b>	<ul style="list-style-type: none"> <li>• What are impacts of remedies on ecosystems?</li> <li>• Will current control remain adequate?</li> <li>• What is likelihood of future contaminant migration?</li> </ul>

### 2.1.6 Timing of Long-Term Stewardship

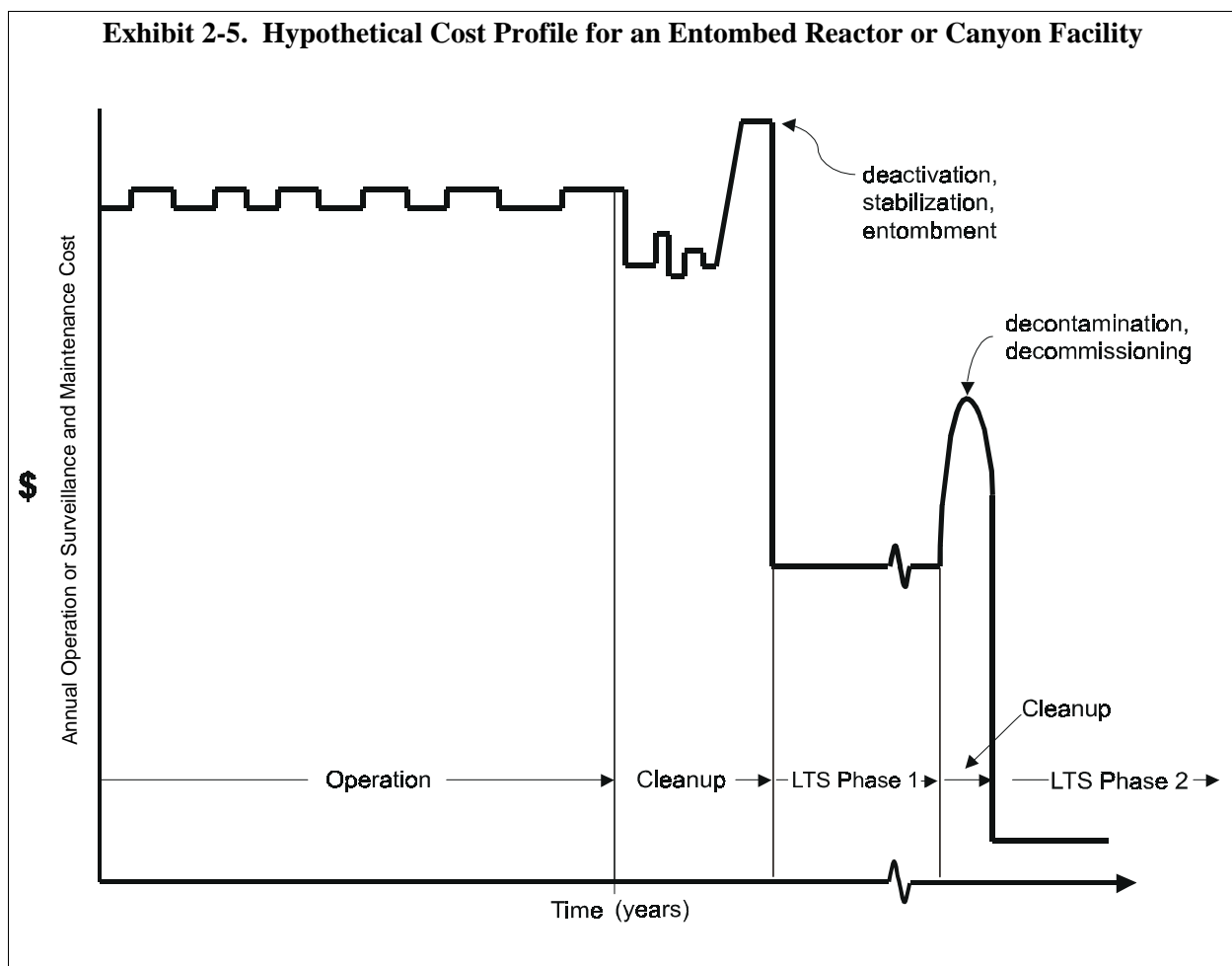
Long-term stewardship is expected to be the longest phase of the nuclear weapons production enterprise's life cycle. The Cold War lasted for approximately 50 years; the cleanup is expected to require roughly another 50 years.<sup>24</sup> Many of the residual contaminants unable to be removed during the cleanup process are expected to remain hazardous virtually forever. Consequently, containment or land use controls will be required for centuries or, in some cases, millennia – orders of magnitude longer than the duration of the Cold War and the active Environmental Management program combined.

Generally, long-term stewardship activities begin when the active cleanup, stabilization, or disposal has been

<sup>24</sup> *Accelerating Cleanup: Paths to Closure*, DOE/EM-0362, June 1998. *Status Report on Paths to Closure*, U.S. Department of Energy Office of Environmental Management, March 2000.

completed in accordance with an applicable regulatory requirement or management plan. However, planning for long-term stewardship should begin well in advance of cleanup completion (i.e., during the cleanup planning process). In some cases, the cleanup plan addresses an entire “geographic site.”<sup>25</sup> In other cases, particularly at the larger and more complex sites, completion of cleanup and beginning of long-term stewardship may occur at a portion of a site long before the entire site reaches closure. Thus far, 34 geographic sites have been cleaned up. These sites are relatively small sites and have a straightforward technical remedy, such as the uranium milling sites. An example of a portion of a larger site is the Experimental Breeder Reactor-1 at the Idaho National Engineering and Environmental Laboratory (INEEL) in Idaho. Cleanup at INEEL’s Experimental Breeder Reactor-1 (a portion of the site) was completed in 1964, but the current estimate for completion of cleanup activities for the entire INEEL site is projected to occur much later (2050).

For many sites and facilities, there are also two phases to performing long-term stewardship (see the hypothetical cost profile in Exhibit 2-5). In most cases, “terminal” long-term stewardship begins when a site or a portion of a site has been cleaned up to the agreed-upon end state. The Department assumes that the terminal long-term stewardship activities will be conducted to maintain the end state as long as necessary (i.e., as long as the hazards require isolation). These activities typically will include maintaining some combination of physical and/or institutional controls, conducting site surveillance and monitoring, and



<sup>25</sup> A discussion of geographic sites and portions of sites is provided in Appendix C: Methodology.



maintaining copies of records in a Federal repository, as well as transferring the records to the appropriate entities (e.g., State or local agencies). These activities should be documented in a detailed long-term stewardship plan prepared before cleanup or closure of the site or the portion of the site has been completed and the site has been transferred to the designated long-term steward (e.g., the Grand Junction Office).

For some facilities – particularly reactors and large processing canyons – an initial “interim” phase of long-term stewardship is needed after a facility has been deactivated (i.e., nuclear materials and other hazardous materials have been stabilized and removed, and unneeded systems have been shut down), but where further remedial action (e.g., decontamination or decommissioning) is not expected to occur for a significant period of time after the deactivation is completed. The relative timing of the two phases of long-term stewardship as they relate to final “cleanup” activities is illustrated in Exhibit 2-5. This exhibit illustrates a hypothetical cost profile for a large facility that operated for several years, underwent initial stabilization and deactivation, and was entombed for several decades while a final disposition strategy was determined (e.g., original reactors at Hanford). After several decades, the facility underwent final decontamination and decommissioning. The activities that occur during the period of entombment could be defined entirely as the first phase of “long-term stewardship.” Once decontamination and decommissioning (i.e., “cleanup”) are complete, the facility would be considered in the terminal phase (phase II) of long-term stewardship.

The interim phase of long-term stewardship was identified explicitly in the FY 2000 NDAA language that led to this Report to Congress:

*The report shall...identify the long-term stewardship responsibilities (for example, longer than 30 years) ... for ... portions of sites for which ... facility stabilization is expected to be completed by the end of calendar year 2006. The report shall contain a description of ... entombed facilities ... and shall also identify the ... containment structure maintenance.*

Hence, if the interim long-term stewardship phase (phase I), beginning prior to 2006, is expected to occur for more than 30 years (e.g., for the entombed Hanford reactors), then the Department’s plans for long-term stewardship will have already been determined and information about the interim activities is included in this Report to Congress.

## **2.2 ASSUMPTIONS AND DATA LIMITATIONS**

A number of assumptions, data limitations, and uncertainties are associated with the data collected for this Report. Programmatic assumptions and data limitations are discussed below. Site-specific assumptions are provided in the site-specific summaries in Volume II of this Report.

### **2.2.1 Scope**

#### *Assumptions*

- Sites where DOE is identified as a potentially responsible party (PRP) and is, therefore, a participant in the cleanup, but is not expected to retain any long-term stewardship responsibilities, are not included in the summary results presented in Volume I of this Report to Congress.
- This analysis includes any site or portion of a site that will require use restrictions as a result of residual contamination. This analysis does not include any sites or portions of a site where DOE Field staff and regulators determined there is no residual contamination, or where contamination was remediated to levels that will allow for unrestricted use.

- There are approximately 300 contaminated facilities that are currently excess or projected to be excess to the DOE Offices of Defense Programs (DP), Nuclear Energy (NE), and Science (SC). Currently, 20 of those facilities are scheduled to be transferred to EM in 2002. This transfer, and future transfers of contaminated excess facilities, will increase the scope and cost of EM's facility deactivation and decommissioning effort and potentially increase the scope and cost of long-term stewardship activities associated with these facilities. EM is working with the transferring programs to determine the processes and schedules for transferring these facilities.
- Twenty-one FUSRAP sites transferred to the Corps in 1987 may be returned to DOE two years after remediation is complete. As of the end of 2000, the extent of long-term stewardship that will be required is not known. For the purpose of this Report to Congress, all of these sites may be expected to require long-term stewardship.

#### *Data Limitations*

- This Report is prepared based on the best available data to date (as of Summer-Fall 2000).
- This Report does not include an uncertain number of low-level radioactive waste sites under NWPA Section 151(b) and (c). These include low-level radioactive waste disposal sites and low-level radioactive waste sites at certain ore processing facilities -- both of which have been or will be remediated by their commercial owners and for which DOE may be authorized (under certain conditions) to take title to the waste and land for long-term stewardship. These sites are not included, with the exception of one for which DOE already has long-term stewardship responsibility (the Parkersburg Site in West Virginia), because of the uncertainty as to whether such sites will be transferred to DOE for long-term stewardship (see Section 2.1.3).
- The definition of what activities should be included in long-term stewardship differs from site to site.
- Long-term stewardship activities are linked to site cleanup and future use decisions. As these decisions are finalized, the Department's long-term stewardship activities may change accordingly.
- Data provided for this Report are for planning purposes only and in no way preempt any ongoing or future regulatory or other decision-making processes.

#### *Uncertainties*

- Changes in scientific understanding of the human health or environmental effects of residual contamination may result in changes to our regulatory standards, resulting in more or less stringent long-term stewardship activities in the future. Similarly, technology developments may enable additional contamination to be removed or change the nature of the long-term stewardship activities required.

### **2.2.2 Schedule**

#### *Assumptions*

- The long-term stewardship process is dynamic, and the specific activities at a site will change over time in response to both site-specific and external factors. These factors include regulatory changes, technology developments, demographic shifts, funding levels, and changes in the contamination due to attenuation or ongoing remediation.

### **2.2.3 Cost** (For a more detailed discussion, see Section 3.4)

#### *Assumptions*

- Cost estimates for activities occurring at sites where cleanup is anticipated to be complete for the entire geographic site during the near-term time period (i.e., through 2006) are more accurate than the longer-range planning estimates (i.e., after 2006).
- Cost estimates are rough estimates based on current site-specific planning assumptions.

#### *Data Limitations*

- For sites where cleanup of the entire site has not been completed and no long-term stewardship plan has been prepared, existing data are largely organized according to DOE project rather than by geographic area. Consequently, the information submitted by Field staff does not describe expected long-term stewardship costs and activities at the geographic portion or site level. However, for those sites at which cleanup has been completed and a Long-Term Surveillance Plan has been prepared, costs and activities at the geographically-defined portion level are provided.
- Although at the site-specific level the costs for long-term stewardship are generally more comprehensive than in past reports, it is still difficult, if not impossible, to draw comparisons of costs for long-term stewardship activities between sites. Sites include and report long-term stewardship activities in their budgets differently.
- The estimated long-term stewardship costs cover long-term stewardship activities through 2070 (currently, most DOE site cost estimates extend to 2070), even though the long-term stewardship activities at some sites will be required for a longer period, possibly in perpetuity.

#### *Uncertainties*

- Long-term stewardship costs are based upon planned, near-term, cleanup funding levels. Changes in these funding levels could affect decisions regarding cleanup decisions and, consequently, the resulting end state and long-term stewardship activities.



**Residential Development Towards the Rocky Flats Environmental Technology Site.** More than 2 million people live within a 50-mile radius of the Rocky Flats Environmental Technology Site, visible in the upper center of this photo. This population is expected to increase by 30 percent within the next 20 years. Residential areas now border the northeastern edge of the site's Buffer Zone. Long-term stewardship requirements will include surveillance and maintenance of engineered caps, long-term monitoring of groundwater and surface water quality, and institutional controls to maintain land use restrictions. *Rocky Flats Environmental Technology Site, Colorado, September 1999.*





**Rulison Marker identifying the site of the 1969 Rulison underground nuclear explosion.** Project Rulison Underground Nuclear Test Explosion Marker. Rulison, Garfield County, Colorado. June 1999.



**Estes Gulch Radioactive Uranium Mill Tailings Disposal Cell.** Rifle, Colorado. April 1998.

## Chapter 3

### Results

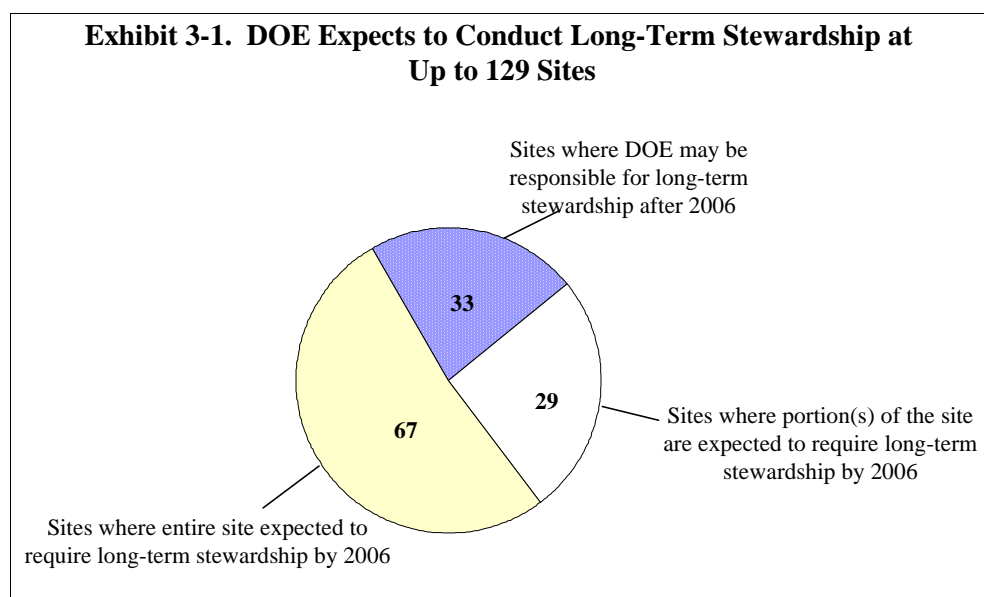




## CHAPTER 3: RESULTS

This chapter summarizes the results of an initial survey of DOE Field offices on their ongoing long-term stewardship activities and their projections for long-term stewardship in the future based on the scope and assumptions discussed in Chapter 2 and the Methodology in Appendix C. Although the primary focus is on the sites or portions of sites where long-term stewardship will be underway by 2006, this chapter also provides general information for the full universe of 129 sites where DOE expected to be responsible for conducting long-term stewardship (see Chapter 2.0, Exhibit 2-1).

The breakdown of the 129 sites expecting to require long-term stewardship is illustrated in Exhibit 3-1. The locations of the various sites are displayed in Exhibit 2-3 and listed in Table 2-1.

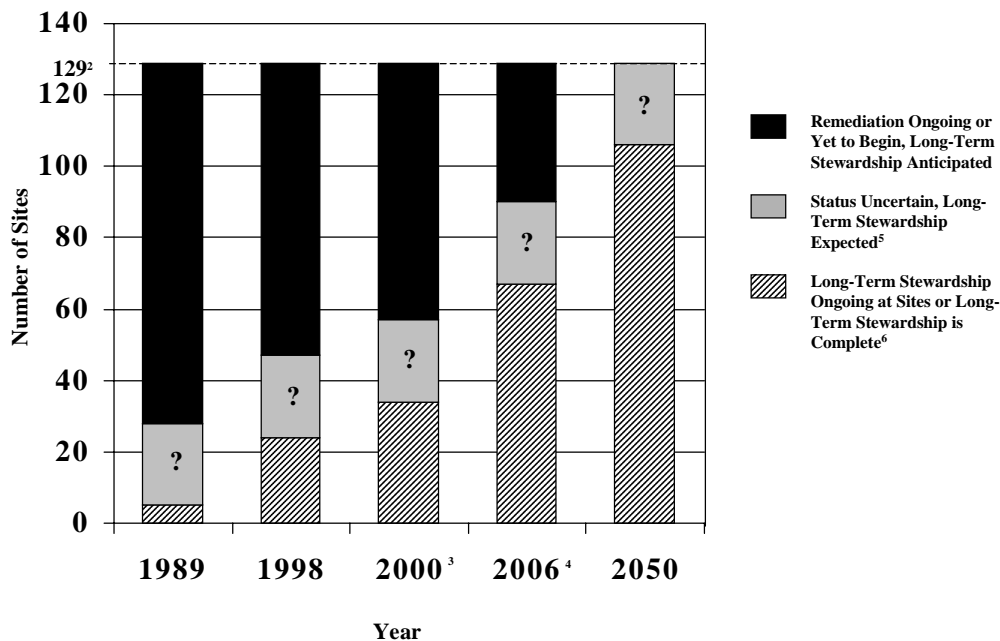


The results in this chapter are drawn from information provided by Field office staff, which was used to generate the site summaries presented in Volume II. This chapter is organized into the following six sections:

- Section 3.1 – DOE expects to perform long-term stewardship activities at 96 sites or portions of sites by 2006
- Section 3.2 – DOE may be responsible for long-term stewardship activities at 33 sites after 2006
- Section 3.3 – DOE's expected long-term stewardship activities
- Section 3.4 – Estimated long-term stewardship costs
- Section 3.5 – Land area requiring long-term stewardship
- Section 3.6 – Who will be involved in performing long-term stewardship?

## From Cleanup to Stewardship - 1989 to 2050

The following exhibit illustrates DOE's progress as it completes cleanup at sites and transitions to long-term stewardship activities. The number of sites where DOE has completed cleanup and is performing long-term stewardship is expected to increase from 24 sites in 1998 to 67 sites in 2006.<sup>1</sup>



<sup>1</sup> This includes only those sites where all cleanup is completed. It excludes a number of sites where cleanup has been completed to levels allowing for unrestricted use, with only record keeping requirements remaining. It also excludes sites where long-term stewardship activities are being performed at portion(s) of the site, while remediation is ongoing at other parts of the site (see footnote 6 below).

<sup>2</sup> DOE has projected that it will eventually be responsible for long-term stewardship at 129 sites. Excluded from this exhibit are 48 sites where cleanup is expected to be completed to levels allowing for unrestricted use, except for record-keeping activities (see Exhibit 2-4 and Section 2.1.2).

<sup>3</sup> DOE is conducting site-wide long-term stewardship activities at 34 sites as of 2000 (see Section 3.1.1.).

<sup>4</sup> DOE is expecting to conduct long-term stewardship activities at 67 sites by 2006 (see Section 3.1.1.).

<sup>5</sup> Of the 33 sites where DOE may be responsible for long-term stewardship activities, the extent and schedule of these activities are currently unknown for 21 sites (see Section 3.2).

<sup>6</sup> This category includes only those sites where all cleanup activities (e.g., cleanup, disposal, and stabilization) have been completed for the entire site. Sites where long-term stewardship activities are being performed at portion(s) of the site, while remediation is ongoing at other parts of the site, are categorized in this exhibit as "Remediation Ongoing or Yet to Begin, Long, Term Stewardship Anticipated."

### 3.1 DOE EXPECTS TO PERFORM LONG-TERM STEWARDSHIP ACTIVITIES AT SITES OR PORTIONS OF 96 SITES BY 2006

DOE expects to perform long-term stewardship activities at 96 sites or portions of sites by 2006. These sites include 67 sites where cleanup activities have already been completed (34 sites) or will be completed (33 sites) for the entire site by the end of 2006. At the remaining 29 sites, long-term stewardship activities are currently required or are expected to be required for portions of the sites. At these 29 sites, although remediation is expected to continue, significant cleanup has been completed at portions of the site. The 67 sites where remediation activities are either completed or will be completed, combined with the 29 sites where remediation has already been completed at portions of the site, represent progress toward the cleanup

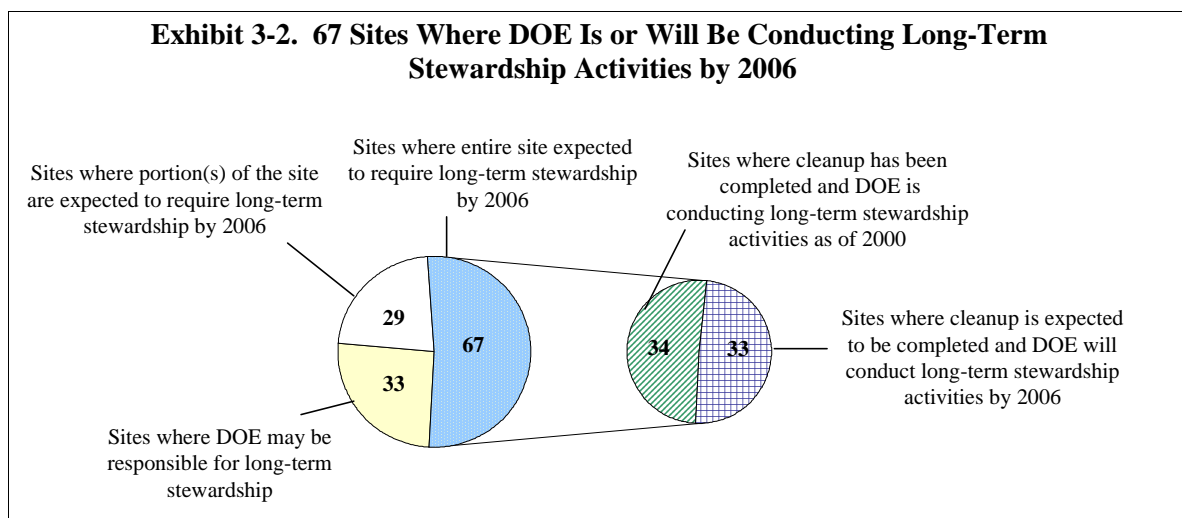
goals DOE established in 1996 for many of its sites.<sup>26</sup>

Although cleanup activities at all sites will not be completed by 2006, the Department expects to complete cleanup activities for a significant proportion of the smaller sites and portions of the larger sites. In fact, at every site where DOE is performing cleanup work, some part of the cleanup will be completed by 2006.<sup>27</sup> This completed cleanup reflects the emphasis the Department places on completing remediation activities -- substantially reducing risks and reducing costs of maintaining safe conditions at the sites, both of which are goals of the Environmental Management program.

### 3.1.1 At 67 Sites, DOE Has Completed or Expects to Complete Cleanup and Expects to Conduct Site-Wide Long-Term Stewardship Activities by 2006

By the end of 2006, DOE expects to conduct long-term stewardship activities at 67 sites where all remediation is expected to be complete and where long-term stewardship activities will be required (see Exhibit 3-2 and Table 3-1). Of these 67 sites, all planned remediation activities have already been completed and DOE is currently conducting long-term stewardship activities at 34 sites (see Appendix D). Remediation work at an additional 33 sites is anticipated to be completed by 2006.

67 SITES	
•	42 UMTRCA Titles I and II sites
•	11 Research and development; testing sites
•	4 Component manufacturing sites
•	4 Fossil energy research sites
•	2 Commercial research reactors sites
•	4 Other sites



The 67 sites are described below in terms of their past missions.

- More than half of the sites (42 of the 67) are former uranium mining, milling and refining sites and uranium mill tailings disposal cells located primarily in western States (mostly in Colorado, New Mexico, and Utah). Many of these sites were or will be remediated by DOE or another responsible party

<sup>26</sup> *Estimating the Cold War Mortgage: The 1995 Baseline Environmental Management Report*, DOE/EM-0232, March 1995 and *The 1996 Baseline Environmental Management Report*, DOE/EM-0290, June 1996.

<sup>27</sup> The DOE will continue to operate the WIPP for disposal of stored transuranic waste beyond 2006. Hence, the term, "cleanup work," in this case, does not include such waste management activities, which will continue after 2006 and require long-term stewardship after completion of disposal activities.

under UMTRCA Titles I and II. Cleanup of these uranium sites is now nearly complete, and the task of long-term stewardship will increasingly require dealing with different types of sites.

- In addition, DOE expects to complete cleanup and implement long-term stewardship activities at 11 research, development, and testing sites by the end of 2006. These sites include national laboratories (e.g., the Sandia and Lawrence Berkeley National Laboratories in California) and some former nuclear test sites (e.g., Amchitka Island, Salmon Site). Unlike most other sites within DOE's purview for long-term stewardship, the national laboratories are currently expected to have ongoing missions beyond environmental cleanup. These include missions in nuclear weapons stockpile stewardship, materials disposition, and nonproliferation support. Institutional controls are already in place for ongoing operations in support of these missions. The long-term stewardship at those sites will be conducted by the landlord organization in accordance with the recently established (December 2000) internal policy regarding long-term stewardship responsibility (see Appendix I).
- Four of DOE's "manufacturing" sites are also expected to complete all planned remediation activities by 2006. These "manufacturing" sites include four component fabrication sites: The Kansas City Plant in Missouri, the Pantex Plant in Texas, the Miamisburg Environmental Management Project (Mound) in Ohio, and the Rocky Flats Environmental Technology Site in Colorado.
- Four of the sites used for fossil energy research are expected to complete remediation activities by 2006. They are the Naval Oil Shale Reserves Site in Colorado, the Hoe Creek Underground Coal Gasification Site, the Naval Petroleum Reserve No. 3 Landfill/Landfarm, and the Rock Springs Oil Shale Retort Site in Wyoming. These sites were used to investigate the process and environmental parameters of underground coal gasification technologies which resulted in residual petroleum hydrocarbon contamination. DOE will be responsible for surveillance and maintenance activities, as well as groundwater and surface vegetation monitoring at these four sites.
- Two sites (the Hallam and Piqua Nuclear Power Facilities) at which DOE is already conducting long-term stewardship activities are former commercial research reactor facilities. At these two sites, long-term stewardship activities include annual inspections and maintenance of the cocooned reactor containment structures.
- The four additional sites where DOE currently is performing long-term stewardship activities are a Nuclear Waste Policy Act (NWPA) site (Parkersburg), a nuclear fuel storage facility (Fort St. Vrain), a FUSRAP site (Bayo Canyon), and a former experimental laboratory and reactor site (Palos Forest (Site A/Plot M) Preserve).

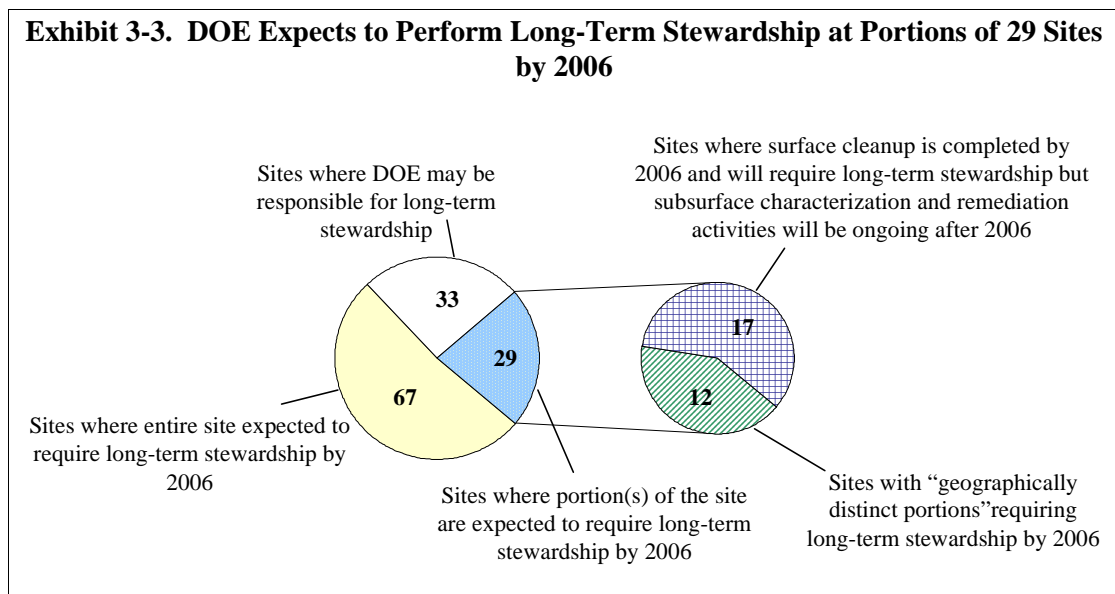
A list of sites by cleanup completion year and site type (e.g., weapons fabrication and uranium mining, milling, and refining, etc.) is provided in Appendix D. Detailed descriptions of the long-term stewardship activities that are anticipated or are ongoing at the 67 sites are provided in Volume II.

**Table 3-1. At 67 Sites, DOE Has Completed or Expects to Complete Cleanup and Expects to Conduct Site-Wide Long-Term Stewardship Activities by 2006**

<i>For 34 Sites, Long-Term Stewardship Activities to Begin by the End of 2000</i>			
State	Site	State	Site
CA	Sandia National Laboratories-CA	NM	Bluewater Site
CO	Bodo Canyon Cell		Lovelace Respiratory Research Institute
	Burro Canyon Disposal Cell	OH	Piqua Nuclear Power Facility
	Cheney Disposal Cell	OR	Lakeview Mill
	Estes Gulch Disposal Cell		Lakeview Site
	Fort St. Vrain	PA	Burrell Site
	Gunnison Disposal Cell		Canonsburg Site
	Maybell Mill Site	PR	Center for Energy and Environmental Research
	Naturita Site	SD	Edgemont Site
	Naval Oil Shale Reserves Site	TX	Falls City Site
ID	Lowman Site	UT	Mexican Hat Site
IL	Fermi National Accelerator Laboratory		Salt Lake City Mill
	Palos Forest (Site A/Plot M) Preserve		South Clive Disposal Cell
NE	Hallam Nuclear Power Facility	WA	(WNI) Sherwood Site
NJ	Princeton Plasma Physics Laboratory	WV	Parkersburg Site
NM	Ambrosia Lake Site	WY	Riverton Site
	Bayo Canyon		Spook Site
<i>For 33 Sites, Long-Term Stewardship Activities to Begin by the End of 2006</i>			
State	Site	State	Site
AK	Amchitka Island	TX	(Conoco) Conquista Site
CA	Lawrence Berkeley National Laboratory		(Exxon) Ray Point Site
	Stanford Linear Accelerator		Pantex Plant
CO	Grand Junction Mill 1	UT	(Atlas) Moab Mill
	Grand Junction Mill 2		Monticello Mill Site and Vicinity Properties
	Gunnison Mill	WY	(ANC) Gas Hills Site
	(HECLA) Durita Site		(Exxon) Highlands Site
	Rocky Flats Environmental Technology Site		Hoe Creek Underground Coal Gasification Site
	(UMETCO) Maybell Site 2		Naval Petroleum Reserve No. 3 Landfill/Landfarm
IL	Argonne National Laboratory East		(Pathfinder) Lucky Mc Site
MS	Salmon Site		(Pathfinder) Shirley Basin Site 2
MO	Kansas City Plant		(Petrochemicals) Shirley Basin Site 1
	Weldon Spring Site		Rock Springs Oil Shale Retort Site
NM	Sandia National Laboratories - NM		(UMETCO) Gas Hills Site
	(SOHIO) LBAR Site		(Union Pacific) Bear Creek Site
OH	Miamisburg Environmental Management Project		(WNI) Split Rock Site
TX	(Chevron) Panna Maria Site		

### 3.1.2 DOE Expects to Perform Long-Term Stewardship Activities at Portions of 29 Sites by 2006

In addition to the 67 sites described in the previous section (where DOE has completed or expects to complete cleanup of the entire site by 2006), there are an additional 29 sites where DOE expects to complete cleanup at portions of the site by 2006. These include: 12 sites where geographically distinct portions of the site will be remediated and will require long-term stewardship; and 17 sites where only the surface will be remediated (and require long-term stewardship) but subsurface characterization and remediation activities will be ongoing (see Exhibit 3-3).



*DOE expects to perform long-term stewardship activities at "geographically distinct portions" of 12 of the 29 sites by 2006*

At 12 of the 29 sites, DOE expects to perform long-term stewardship activities at "geographically distinct portions" of the site by 2006. Table 3-2 provides a description of the portions of the sites where remediation activities are expected to be completed and where long-term stewardship activities will be required. The remediation challenges posed by the contaminants and environmental conditions at many other areas of these sites (e.g., high-level waste and transuranic waste issues, multiple types of waste and contaminants present) will require longer periods of time for completion of cleanup. At most of these sites, investigations are still underway to better understand the nature of the contamination and to identify the most appropriate remediation strategies for the sites or portions of sites. In some cases, negotiations are still ongoing with stakeholders and regulators to identify acceptable remediation strategies and, consequently, the resulting end state and subsequent long-term stewardship requirements have yet to be determined.

**Table 3-2. DOE Anticipates Performing Long-Term Stewardship Activities at “Geographically Distinct Portions” of 12 Sites by 2006**

<i>State</i>	<i>Site</i>	<i>Description of long-term stewardship activities, ongoing remediation, and site characterization</i>
California	Lawrence Livermore National Laboratory - Livermore Site	While cleanup activities at the Livermore Site are not expected to be complete by 2007, many key long-term stewardship operational components have already been initiated concurrent with the active, compliant cleanup program. Similarly, several administrative and institutional controls and surveillance/maintenance programs that currently exist will be maintained to support the overarching long-term stewardship goals of maintaining and operating required remediation systems and ensuring that selected remedies will remain protective of human health and the environment.
California	Lawrence Livermore National Laboratory - Site 300	While DOE does not expect to have assessed and completed all release sites and associated groundwater treatment systems at Site 300 until 2009, activities are currently being conducted at several completed release site(s) that are consistent and commensurate with the overall planned long-term stewardship goals for the site. Portions of the site that require long-term stewardship activities include areas with soil and groundwater contamination resulting from past operations and releases from spills, as well as closed waste treatment and land disposal facilities. By 2009, all release sites at Site 300 will have been assessed and completed and all groundwater treatment systems and other remedial actions will be in place and operational.
Idaho	Idaho National Engineering and Environmental Laboratory	Remediation is projected to be complete prior to 2006 at several small areas of the site. These areas will require monitoring and maintaining engineered units, enforcing institutional controls, and restricting access. The Ordnance Area is a large tract of 210,000 acres that will require access restrictions. Because the site is not scheduled to complete remediation until 2050, many areas will have ongoing remediation, such as waste consolidation.
Kentucky	Paducah Gaseous Diffusion Plant	At Paducah, there are several capped engineered units where long-term monitoring has already begun. Additionally, there is ongoing surface water monitoring. However, remediation of the entire site is not anticipated to be complete until 2010.
Nevada	Nevada Test Site	Remediation has been completed at 18 industrial sites at Nevada Test Site and 13 industrial areas at the Tonopah Test Range, such as capped landfills. Contaminant characterization (e.g., a comprehensive groundwater analysis) is ongoing at these and other areas of the Nevada Test Site. Other areas of the site are not scheduled to begin remediation until well after 2006. By 2017, all remedial activities at the Nevada Test Site will be completed and the entire site will require long-term stewardship.
New Mexico	Los Alamos National Laboratory	Of the 2,146 potential release sites identified at LANL, 719 were slated for further investigation or accelerated remediation. To date, DOE has proposed approximately 1,400 potential release sites to the New Mexico Environment Department for "No Further Action." Current long-term stewardship-related activities include: 1) planning for and implementing long-term stewardship activities, such as the long-term surveillance and monitoring efforts needed for the Material Disposal Areas that have covers as a proposed remedy; 2) site-wide monitoring of drinking water supplies; 3) active partnering with the regulatory authorities; and 4) monitoring sites where interim measures have been performed. Monitoring these sites will continue until such time as the final corrective measure investigations are completed, as well as inspections of the sites where remedial actions have been completed.
New York	Brookhaven National Laboratory*	Multiple landfills at the site are projected to be capped and to require long-term monitoring beginning in 2003. Long-term monitoring at the graphite research reactor is anticipated to begin in 2006.



**Table 3-2. DOE Anticipates Performing Long-Term Stewardship Activities at “Geographically Distinct Portions” of 12 Sites by 2006**

<i>State</i>	<i>Site</i>	<i>Description of long-term stewardship activities, ongoing remediation, and site characterization</i>
Ohio	Fernald Environmental Management Project	DOE will complete most of the planned remediation activities at the Fernald site by 2006. Many of these areas are subject to land use restrictions, such as the onsite disposal facility. Other areas will require periodic monitoring. The only areas with ongoing remediation beyond 2006 are the silos and wastewater treatment facility.
Ohio	Portsmouth Gaseous Diffusion Plant*	For management purposes, the site has been divided into quadrants. Within each of the site quadrants, some remediation activities will be completed by 2000 (primarily groundwater monitoring and pump and treat systems). However, remediation is expected to continue for other areas within each of these quadrants beyond 2006.
South Carolina	Savannah River Site	Long-term stewardship activities, such as institutional controls, maintenance of treatment systems, and groundwater monitoring, are forecasted to begin at several watershed portions of the site by 2006 (watershed portions include: Upper Three Runs, Lower Three Runs, Steel Creek, Pen Branch, Four Mile Branch, and the Savannah River and Floodplain Swamp). However, significant remediation work will be required beyond 2006 for these areas. Surveillance and maintenance activities are also forecasted to begin by 2006 at five facility portions (facilities that have been or will be deactivated by 2006 but for which final decisions have not been made on their decommissioning).
Tennessee	Oak Ridge Reservation	Long-term stewardship activities, such as monitoring of groundwater and surface water and maintaining engineered caps, will have begun at offsite locations, as well as the Bear Creek, Melton Valley, Bethel Valley, and East Fork Poplar Creek Watersheds, which are all located within the site boundary, by 2000. However, significant remediation activities, such as consolidating waste and capping disposal cells, are expected to continue beyond 2006 for these and other areas of the site.
Washington	Hanford Site	DOE anticipates it will be conducting many long-term stewardship activities by 2006, including the interim safe storage of multiple test reactors, groundwater monitoring, and maintaining engineered caps on disposal cells. Remediation for the entire site is not scheduled to be complete until 2048. Major ongoing remediation activities will include waste consolidation in the 23-acre Environmental Restoration Disposal Facility.

\* The scope of remediation work has recently been updated at these sites.

*DOE expects to have surface remediation complete at 17 of the 29 Sites by 2006, with ongoing subsurface characterization and remediation activities continuing after 2006* <sup>28</sup>

DOE has already completed surface remediation at 11 former mill tailings sites. However, groundwater has not been characterized enough to obtain NRC approval for selection of the subsurface remedy. Until a final remedy is selected, the subsurface of the site will not be subject to long-term stewardship. At six former nuclear test sites, DOE expects to complete surface remediation prior to 2006, but will continue subsurface characterization beyond 2006. Brief descriptions of each of these sites are provided in Table 3-3.

<sup>28</sup> In some cases, cleanup of the site's surface has been completed, but subsurface remediation (e.g., groundwater characterization and cleanup) has not yet been completed. In these cases, “cleanup” refers to the surface portion of a site rather than the whole site (see “cleanup” definition in Chapter 1). In this Report, completed surface remediation requiring long-term stewardship is identified separately from the long-term stewardship activities required for subsurface contamination.

**Table 3-3. DOE Expects to Perform Long-Term Stewardship Activities at 17 Sites Where Surface Remediation is Expected to be Completed by 2006, but Subsurface Characterization Will Continue Beyond 2006**

<i>State</i>	<i>Site</i>	<i>Description of long-term stewardship activities, ongoing remediation, and site characterization</i>
Arizona	Monument Valley Site	Surface remediation was completed in 1994, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2013.
	Tuba City Site	Surface remediation was completed in 1990, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2011.
Colorado	Durango Mill	Surface remediation was completed in 1990, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2007.
	Naturita Mill	Surface remediation was completed in 1997, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2009.
	Rifle (New) Mill	Surface remediation was completed in 1995, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2008.
	Rifle (Old) Mill	Surface remediation was completed in 1995, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2008.
	Rio Blanco	Soil remediation will be completed by 2006. However, subsurface characterization is expected to continue until 2009. Ongoing long-term stewardship activities include subsurface intrusion restrictions.
	Rulison	Soil remediation will be completed by 1998. However, subsurface characterization is expected to continue until 2010. Ongoing long-term stewardship activities include subsurface intrusion restrictions.
	Slick Rock (North Continent) Mill 1	Surface remediation was completed in 1996, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2008.
	Slick Rock (Union Carbide) Mill 2	Surface remediation was completed in 1996, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2008.
Florida	Pinellas STAR Center	Surface remediation was completed in 1999, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2015.
Nevada	Central Nevada Test Area	Soil remediation will be completed by 2001. However, groundwater characterization is expected to continue until 2012. Ongoing long-term stewardship activities include subsurface intrusion restrictions.

**Table 3-3. DOE Expects to Perform Long-Term Stewardship Activities at 17 Sites Where Surface Remediation is Expected to be Completed by 2006, but Subsurface Characterization Will Continue Beyond 2006**

<i>State</i>	<i>Site</i>	<i>Description of long-term stewardship activities, ongoing remediation, and site characterization</i>
	Project Shoal	Soil remediation will be completed by 1998. However, groundwater characterization is expected to continue until 2009. Ongoing long-term stewardship activities include subsurface intrusion restrictions.
New Mexico	Gasbuggy Site	Soil remediation will be completed by 2006. However, subsurface characterization is expected to continue until 2014. Ongoing long-term stewardship activities include subsurface intrusion restrictions.
	Gnome-Coach	Soil remediation will be completed by 2005. However, groundwater characterization is expected to continue until 2012. Ongoing long-term stewardship activities include subsurface intrusion restrictions.
	Shiprock Site	Surface remediation was completed in 1996, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2012.
Utah	Green River Site	Surface remediation was completed in 1998, but groundwater characterization will continue beyond 2006. Groundwater long-term stewardship activities are anticipated to begin in 2009.

### 3.2 DOE MAY BE RESPONSIBLE FOR LONG-TERM STEWARDSHIP ACTIVITIES AT 33 SITES

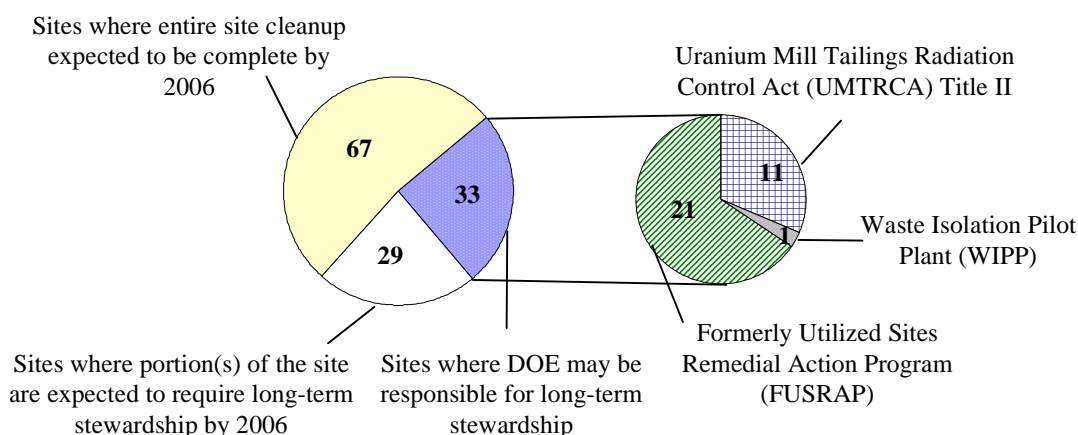
DOE has identified 33 sites where it may be responsible for performing long-term stewardship activities. This includes 11 UMTRCA Title II sites where DOE is not responsible for the cleanup but is responsible for long-term stewardship activities, and the Waste Isolation Pilot Plant (WIPP) which DOE is expected to continue operating (accepting transuranic waste for disposal) until after 2006. Additionally, there are 21 FUSRAP sites where the cleanup responsibility was transferred to the Corps in 1997 by the U. S. Congress. Generally, less detailed information is available for the types of long-term stewardship activities anticipated at these sites because decisions affecting their end states have not yet been made and, consequently, the long-term stewardship requirements remain uncertain. These sites are illustrated below in Exhibit 3-4.

- Eleven sites are expected to be transferred to DOE in accordance with UMTRCA Title II. These sites are currently privately owned, but DOE expects it will assume ownership of and responsibility for long-term stewardship at these sites some time after 2006, following completion of remediation activities (not expected to be complete by 2006). DOE is not responsible for completing remediation at these sites; remediation will be performed by the site owners, with partial reimbursement of costs by DOE.

#### 11 SITES TO BE TRANSFERRED UNDER UMTRCA TITLE II

Colorado	(Cotter) Cañon City Site (UMETCO) Uravan Site
New Mexico	(Homestake) Grants Site (Quivira) Ambrosia Lake Site 2 (UNC) Church Rock Site
Utah	(EFN) White Mesa Site (Plateau) Shootaring Canyon Site (Rio Algom) Lisbon Valley Site 11e.(2) Disposal Site
Washington	(Dawn) Ford Site
Wyoming	(Kennecott) Sweetwater Site

**Exhibit 3-4. 33 Sites Where DOE May Be Responsible for Long-Term Stewardship Activities**



- The Waste Isolation Pilot Plant (WIPP) is a transuranic waste disposal site near Carlsbad, New Mexico. The anticipated closure date for WIPP is 2034, after the last shipment of waste has been received and emplaced. DOE expects that long-term stewardship activities at WIPP will begin in 2039, after the facility has been decontaminated and decommissioned.
- The Energy and Water Development Appropriations Act for Fiscal Year 1998 transferred responsibility for the administration and execution of FUSRAP from DOE to the Corps. The Department and the Corps signed a Memorandum of Understanding (MOU) in March 1999 identifying the roles and responsibilities for cleanup and post-closure care of FUSRAP sites. For the 21 sites assigned to the Corps for remediation, the MOU assigns responsibility to DOE for any required long-term stewardship. At these sites, long-term stewardship may be required subject to the Corps records of decision and completion of cleanup. DOE and the Corps have discussed a protocol that will include written approval of the cleanup by the appropriate Federal and State agencies and transfer of post-closure documents, including adequate and acceptable radiological surveys. These sites will be transferred to DOE for long-term stewardship, as appropriate, two years after the Corps completes remedial actions. However, because the cleanup decisions for these sites are not yet final, the level of long-term stewardship activities required for these sites, if any, is not yet known.

**21 FUSRAP SITES TRANSFERRED TO THE U.S. ARMY CORPS OF ENGINEERS IN 1997 FOR CLEANUP**

Connecticut	CE	New Jersey (cont.)	Wayne Site
Illinois	Madison	New York	Ashland Oil #1
Maryland	W.R. Grace and Company		Ashland Oil #2
Massachusetts	Shpack Landfill		Bliss and Laughlin Steel
Missouri	Latty Avenue Properties		Colonie
	St. Louis Airport Site		Linde Air Products
	St. Louis Airport Site Vicinity Properties		Niagara Falls Storage Site
	St. Louis Downtown Site		Seaway Industrial Park
New Jersey	DuPont & Company	Ohio	Luckey
	Maywood Chemical Works		Painesville
	Middlesex Sampling Plant		

### 3.3 DOE'S EXPECTED LONG-TERM STEWARDSHIP ACTIVITIES

Long-term stewardship activities will range in level of effort and complexity. This section identifies activities for the five media types where long-term stewardship is expected to be required: residually contaminated groundwater, residually contaminated soils, engineered units, contaminated facilities, and residually contaminated surface waters and sediments.

The types of long-term stewardship activities required at sites will relate directly to the types of residually contaminated media that will remain at the sites. These activities include institutional controls, such as maintaining deed restrictions and fences, and engineered controls, such as conducting monitoring and maintaining erosion control for caps. Many of these activities will be applied across an entire site (e.g., deed restrictions), while other activities will be specific to a given medium (e.g., monitoring and maintenance of a groundwater pump and treat system).

There are considerable differences in the way site personnel have defined and reported these activities. For example, some site personnel consider deed restriction and access controls as the same long-term stewardship activity, while others reported them as two distinct activities. Therefore, the intent of this section is not to provide a definite answer to questions such as “how many monitoring wells will DOE have?,” but to indicate the general types of activities that will be required across the DOE complex so as to illustrate the nature and overall magnitude of the challenges ahead.

Detailed descriptions of the long-term stewardship activities required at each site are provided in the site summaries in Volume II. Table 3-4 provides a summary of the media that are subject to long-term stewardship at the 129 sites where DOE expects to perform long-term stewardship activities.

**Table 3-4. Summary of Media Requiring Long-Term Stewardship**

<i>State</i>	<i>Site Name</i>	<i>Long-Term Stewardship Start Date</i>	<i>Media</i>				
			<i>Facilities</i>	<i>EU*</i>	<i>Soil</i>	<i>GW*</i>	<i>SW*</i>
Alaska	Amchitka Island	2004			✓	✓	
Arizona	Monument Valley Site <sup>a</sup>	1994				✓	
	Tuba City Site	1990		✓		✓	
California	Lawrence Berkeley National Laboratory	2005			✓	✓	
	Lawrence Livermore National Laboratory - Livermore Site	1989			✓	✓	
	Lawrence Livermore National Laboratory - Site 300	1994		✓	✓	✓	✓
	Sandia National Laboratories - CA	1999		✓	✓	✓	
	Stanford Linear Accelerator	2004			✓	✓	
Colorado	Bodo Canyon Cell	1990		✓			
	Burro Canyon Disposal Cell	1998		✓			
	Cheney Disposal Cell	1994		✓			
	(Cotter) Cañon City Site	2020		✓		✓	
	Durango Mill <sup>a</sup>	1990				✓	
	Estes Gulch Disposal Cell	1997		✓			
	Fort St. Vrain	1999	✓				

**Table 3-4. Summary of Media Requiring Long-Term Stewardship**

State	Site Name	Long-Term Stewardship Start Date	Media				
			Facilities	EU*	Soil	GW*	SW*
	Grand Junction Mill 1	2001				✓	
	Grand Junction Mill 2 <sup>b</sup>	2001				✓	✓
	Gunnison Disposal Cell	1995		✓			
	Gunnison Mill <sup>a</sup>	1994				✓	
Colorado	(HECLA) Durita Site	2001		✓			
	Maybell Mill Site	1999		✓		✓	
	Naturita Mill <sup>a</sup>	1997				✓	
	Naturita Site	1999		✓			
	Naval Oil Shale Reserves Site	2000				✓	
	Rifle (New) Mill <sup>a</sup>	1995				✓	
	Rifle (Old) Mill <sup>a</sup>	1995				✓	
	Rio Blanco <sup>a,c</sup>	2006			✓	✓	
	Rocky Flats Environmental Technology Site	2006	✓	✓	✓	✓	✓
	Rulison <sup>a, c</sup>	1998				✓	
	Slick Rock (North Continent) Mill 1 <sup>a</sup>	1996				✓	
	Slick Rock (Union Carbide) Mill 2 <sup>a</sup>	1996				✓	
	(UMETCO) Maybell Site 2	2001		✓		✓	
	(UMETCO) Uravan Site	2010		✓		✓	
Connecticut	CE <sup>d</sup>	Extent of long-term stewardship currently unknown					
Florida	Pinellas STAR Center <sup>b</sup>	2015				✓	
Idaho	Idaho National Engineering and Environmental Laboratory <sup>c</sup>	1964	✓	✓	✓	✓	
	Lowman Site	1994		✓			
Illinois	Argonne National Laboratory East	2001	✓	✓	✓	✓	✓
	Fermi National Accelerator Laboratory	1999		✓			
	Madison <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Palos Forest (Site A/Plot M) Preserve	1997		✓		✓	
Iowa	Ames Laboratory	Long-term stewardship not expected beyond record-keeping activities					
Kentucky	Paducah Gaseous Diffusion Plant <sup>c</sup>	2000	✓	✓	✓	✓	✓
Maryland	W.R. Grace and Company <sup>d</sup>	Extent of long-term stewardship currently unknown					
Massachusetts	Shpack Landfill <sup>d</sup>	Extent of long-term stewardship currently unknown					
Mississippi	Salmon Site	2003				✓	
Missouri	Kansas City Plant	2005			✓	✓	✓
	Latty Avenue Properties <sup>d</sup>	Extent of long-term stewardship currently unknown					
	St. Louis Airport Site <sup>d</sup>	Extent of long-term stewardship currently unknown					

**Table 3-4. Summary of Media Requiring Long-Term Stewardship**

State	Site Name	Long-Term Stewardship Start Date	Media				
			Facilities	EU*	Soil	GW*	SW*
	St. Louis Airport Site Vicinity Properties <sup>d</sup>	Extent of long-term stewardship currently unknown					
	St. Louis Downtown Site <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Weldon Spring Site	2003		✓		✓	
Nebraska	Hallam Nuclear Power Facility	1998	✓				
Nevada	Central Nevada Test Area <sup>a</sup>	2001		✓		✓	
	Nevada Test Site <sup>f</sup>	2009		✓	✓	✓	
	Project Shoal <sup>a</sup>	1998				✓	
New Jersey	DuPont & Company <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Maywood Chemical Works <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Middlesex Sampling Plant <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Princeton Plasma Physics Laboratory	2000				✓	
	Wayne Site <sup>d</sup>	Extent of long-term stewardship currently unknown					
New Mexico	Ambrosia Lake Site	1998		✓			
	Bayo Canyon	1982			✓		
	Bluewater Site	1997		✓		✓	
	Gasbuggy Site <sup>a,c</sup>	2006			✓	✓	
	Gnome-Coach <sup>a,c</sup>	2005			✓	✓	
	(Homestake) Grants Site	2015		✓		✓	
	Los Alamos National Laboratory	1993	✓	✓	✓	✓	✓
	Lovelace Respiratory Research Institute	1994			✓	✓	
	(Quivira) Ambrosia Lake Site 2	2015		✓		✓	
	Sandia National Laboratories - NM	2000		✓	✓	✓	
	Shiprock Site	1996		✓		✓	
	(SOHIO) LBAR Site	2001		✓		✓	
	(UNC) Church Rock Site	2015		✓		✓	
	Waste Isolation Pilot Plant	2040		✓			
New York	Ashland Oil #1 <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Ashland Oil #2 <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Bliss and Laughlin Steel <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Brookhaven National Laboratory <sup>b,e</sup>	2003	✓	✓	✓	✓	✓
	Colonie <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Linde Air Products <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Niagara Falls Storage Site <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Seaway Industrial Park <sup>d</sup>	Extent of long-term stewardship currently unknown					
	West Valley Demonstration Project <sup>g</sup>	Long-term stewardship responsibility not determined					
Ohio	Fernald Environmental Management Project <sup>e</sup>	2006		✓	✓	✓	



**Table 3-4. Summary of Media Requiring Long-Term Stewardship**

State	Site Name	Long-Term Stewardship Start Date	Media				
			Facilities	EU*	Soil	GW*	SW*
	Luckey <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Miamisburg Environmental Management Project <sup>e</sup>	2000	✓		✓	✓	
	Painesville <sup>d</sup>	Extent of long-term stewardship currently unknown					
	Piqua Nuclear Power Facility	1998	✓				
	Portsmouth Gaseous Diffusion Plant <sup>b,e</sup>	2000	✓	✓		✓	✓
Oregon	Lakeview Mill	2000				✓	
	Lakeview Site	1995		✓			
Pennsylvania	Burrell Site	1994		✓		✓	
	Canonsburg Site	1996		✓		✓	
Puerto Rico	Center for Energy and Environmental Research	1970	✓				
South Carolina	Savannah River Site <sup>e</sup>	1996	✓	✓	✓	✓	
South Dakota	Edgemont Site	1996		✓			
Tennessee	Oak Ridge Reservation <sup>e</sup>	1997	✓	✓	✓	✓	✓
Texas	(Chevron) Panna Maria Site	2001		✓		✓	
	(Conoco) Conquista Site	2002		✓		✓	
	(Exxon) Ray Point Site	2001		✓			
	Falls City Site	1997		✓		✓	
	Pantex Plant	2003		✓	✓	✓	✓
Utah	(Atlas) Moab Mill <sup>b</sup>	2005				✓	✓
	(EFN) White Mesa Site	2025		✓			
	Green River Site	1998		✓		✓	
	Mexican Hat Site	1997		✓		✓	
	Monticello Mill Site and Vicinity Properties	2001		✓	✓	✓	
	(Plateau) Shootaring Canyon Site	2015		✓			
	(Rio Algom) Lisbon Valley Site	2010		✓		✓	
	Salt Lake City Mill	1989				✓	
	South Clive Disposal Cell	1997		✓			
	11e.(2) Disposal Site	Extent of long-term stewardship currently unknown					
Washington	(Dawn) Ford Site	2019		✓		✓	
	Hanford Site <sup>e</sup>	2000	✓	✓	✓	✓	
	(WNI) Sherwood Site	2000		✓		✓	
West Virginia	Parkersburg Site	1983		✓			
Wyoming	(ANC) Gas Hills Site	2001		✓		✓	
	(Exxon) Highlands Site	2002		✓		✓	
	Hoe Creek Underground Coal Gasification Site	2004				✓	

**Table 3-4. Summary of Media Requiring Long-Term Stewardship**

State	Site Name	Long-Term Stewardship Start Date	Media				
			Facilities	EU*	Soil	GW*	SW*
	(Kennecott) Sweetwater Site <sup>i</sup>	unknown				✓	
	Naval Petroleum Reserve No. 3 Landfill/Landfarm	2001		✓		✓	
	(Pathfinder) Lucky Mc Site	2005		✓		✓	
	(Pathfinder) Shirley Basin Site 2	2006		✓		✓	
	(Petrochemicals) Shirley Basin Site 1	2002		✓		✓	
	Riverton Site <sup>a</sup>	1989				✓	
	Rock Springs Oil Shale Retort Site	2005				✓	
	Spook Site	1993		✓			
	(UMETCO) Gas Hills Site	2002		✓		✓	
	(Union Pacific) Bear Creek Site	2001		✓		✓	
	(WNI) Split Rock Site	2002		✓		✓	
<b>TOTAL SITES</b>		<b>131<sup>29</sup></b>	<b>15</b>	<b>70</b>	<b>27</b>	<b>83</b>	<b>11</b>

\* EU = engineered unit, GW = groundwater, and SW = surface water/sediments.

<sup>a</sup> Long-term stewardship activities for these sites are divided into two categories: the surface and the subsurface. The long-term stewardship start date reflects the surface remediation completion date. Subsurface characterization and remediation are ongoing. In some cases, the subsurface remedy is yet to be determined by regulators.

<sup>b</sup> The scope of remediation has changed since data were submitted to EM's IPABS-Information System as part of the Spring 2000 data call. Therefore, long-term stewardship start dates have been updated.

<sup>c</sup> As a result of nuclear explosion tests conducted on the site, underground supplies of natural gas were contaminated with radioactivity. This natural gas will require long-term stewardship indefinitely because remediation is technically infeasible.

<sup>d</sup> The extent of long-term stewardship activities at 21 FUSRAP sites is currently uncertain. The Army Corps of Engineers is responsible for cleanup of these sites, and the extent of DOE's long-term stewardship responsibilities, if any, will depend on final cleanup decisions that have yet to be made.

<sup>e</sup> The long-term stewardship start date for these sites represents when the first portion or an area began or will begin long-term stewardship activities. Many sites will not be entirely in long-term stewardship until well after 2006.

<sup>f</sup> The long-term stewardship start date represents when all soil sites are planned to have been remediated. However, significant remediation progress has been made at the site that currently requires some level of long-term stewardship activities.

<sup>g</sup> DOE's responsibility for long-term stewardship, if any, has not yet been determined. Negotiations with regulators (including determination of NEPA requirements) are still ongoing.

<sup>h</sup> The FY 2001 NDAA required DOE to prepare a plan for remediation of this site, including groundwater restoration, in accordance with UMTRCA Title I. Remedial action, including removal and permanent disposition of the tailings at a disposal site in Utah, will commence as soon as practicable after completion of the plan. The extent of long-term stewardship activities has yet to be determined.

<sup>i</sup> The long-term stewardship start date has yet to be determined.

### 3.4 ESTIMATED LONG-TERM STEWARDSHIP COSTS

This section summarizes the results of the cost information compiled from the individual sites identified in Sections 3.1 and 3.2. The information represents DOE's first comprehensive effort to compile cost estimates associated with current and expected long-term stewardship activities. Consequently, the cost data should

<sup>29</sup> In addition to 129 sites expected to require long-term stewardship by DOE, Ames Laboratory in Iowa and the West Valley Demonstration Project in New York are included for informational purposes only. Therefore, the total number of sites included in the table is 131.

be considered preliminary, order-of-magnitude estimates. Although some cost data reflects operational experience (particularly at DOE's Grand Junction Office), most of the data is based largely on projections (and current site-specific planning assumptions) -- rather than validated baselines -- of the known or anticipated scope of long-term stewardship activities at individual sites. Moreover, the projected scope and costs for long-term stewardship may be based on either known or anticipated cleanup end states. The accuracy and precision of these estimates are related directly to the certainty of the scope of the long-term stewardship requirements, and indirectly to the certainty regarding the cleanup end states.

The information used in developing the cost estimates presented in this Report varied greatly from site to site depending on the status of cleanup activities. Sites where cleanup has been completed or is nearing completion tend to have better defined scope, schedule, and cost for long-term stewardship than the sites where cleanup activities are expected to continue well into the future, particularly where the "end state" for the site has not been proposed, agreed to, or determined. There are also varying levels of understanding of the expected long-term stewardship activities at most sites. The level of understanding varies primarily because, to date, most sites do not have staff dedicated to identifying and defining the scope of long-term stewardship.

Long-term stewardship cost information can be grouped into the following three broad categories:

- *Sites where cleanup (including stabilization and disposal) is either completed or largely completed and long-term stewardship activities have been conducted:* At these sites, there is a great deal of confidence in the accuracy of the cost information for long-term stewardship activities (see Section 3.1.1). These sites include former uranium mining, milling, and refining sites, as well as uranium mill tailings disposal sites, managed by DOE's Grand Junction Office (through its Long-Term Surveillance and Maintenance Program); relatively small nuclear reactor sites (e.g., the Piqua Nuclear Power Facility in Ohio and the Hallam Nuclear Power Facility in Nebraska); and sites nearing project completion (e.g., the Weldon Spring Site in Missouri).
- *Sites where cleanup has been completed at portions of the site but cleanup is still continuing and expected to continue beyond 2006 for other areas of the site (see Section 3.1.2):* This group includes various categories of sites, such as former uranium mining, milling, and refining sites; research, development, and testing sites; and other sites that supported the Department's past nuclear weapons

#### HOW SHOULD LONG-TERM STEWARDSHIP COST ESTIMATE DATA BE PRESENTED?

Summarizing cost estimate data for DOE's anticipated long-term stewardship activities requires consideration of how the information should be most accurately and clearly presented. First, costs are presented in thousands of constant 2000 dollars. Conducting the analyses and reporting costs in constant dollars allows "apples-to-apples" comparisons between different sites and also provides an indicator on how much long-term stewardship will cost in "today's dollars" (i.e., accounting for inflation and the "value of money"). The alternative (current dollars) would inaccurately cause the costs to appear to be increasing. Moreover, net present value for costs are not used because it could appear to make costs disappear after 30 years. Because the Department has indicated that it is committed to considering the long-term costs and consequences of its decisions, net present value could appear to undervalue these long-term costs.

Second, the use of life-cycle costs has been the normal method of presenting cost information since the Department's first baseline report in 1995. However, in the case of long-term stewardship costs, life-cycle information is not appropriate, and annual costs are used instead. Defining "life-cycle costs" for the long term is not meaningful in the same way that costs for projects with a predictable end point are calculated because there is no clear end point for long-term stewardship, in most cases.

Finally, although long-term stewardship will be required in perpetuity at many sites, for the purpose of this Report, costs are reflected only through 2070. Costs estimated out to 2070 should be viewed as an indicator for the "magnitude" of the projected long-term stewardship scope rather than a point where all long-term stewardship activities will end. Consequently, most analyses in this Report provide annual cost estimates over time rather than "life-cycle costs."

activities. The quality and availability of cost data for these sites varies greatly. For example, cost estimates for uranium mining, milling, and refining sites where DOE has not yet taken responsibility for long-term stewardship are likely to be comparable to costs of similar work where DOE has already gained operational experience. Hence, DOE's confidence in the cost estimate is high. For other sites, cost estimates are less precise because either end states are not yet defined or remediation decisions are still pending. Consequently, the scope of long-term stewardship activities required to generate cost estimates are yet to be defined. The accuracy of cost estimates should improve at these sites as cleanup nears completion (either for the entire site or portions of a site) and long-term stewardship plans are prepared. In many cases, cost estimates can be developed based on experience with similar activities conducted at other sites. For example, since the nature and extent of long-term stewardship activities are similar for capped landfills, the cost estimates for existing landfills can provide a useful basis for estimating costs at future landfills requiring similar long-term stewardship activities at other sites.

- *Sites where DOE may be responsible for long-term stewardship activities (see Section 3.2):* This category includes sites where the extent of long-term stewardship is currently unknown and, therefore, reliable cost estimates cannot be developed. At most of these sites, cleanup activities are still being conducted by an entity other than DOE – for example, the remediation of 21 FUSRAP sites is currently the responsibility of the U.S. Army Corps of Engineers.

The scope of this Report focuses primarily on the sites in the first two categories, particularly those sites or portions of sites where remediation is expected to be completed by 2006. For those sites or portions of sites where cleanup is not expected to be completed by 2006, DOE and its contractors will develop more detailed information on costs and technical requirements for long-term stewardship activities as DOE and regulators make decisions (in conjunction with Indian tribes, local governments and stakeholders) on cleanup, disposal, and stabilization.

In addition to the varying levels of information available on anticipated long-term stewardship activities and costs, the process used by sites to budget for long-term stewardship varies. Most sites have not established long-term stewardship as a specific project with distinct and discrete performance metrics. Some sites include long-term stewardship as part of the budget for each cleanup project. Some sites include certain long-term stewardship activities (e.g., records management and site security) as part of the overall infrastructure maintenance activities.

DOE staff are currently working to improve the methods for estimating long-term stewardship costs (i.e., developing guidance and cost models). They anticipate including long-term stewardship cost estimates in the FY 2003 budget formulation process, which will require that site personnel define the technical scope and schedules with enough detail to develop reliable cost estimates (e.g., in a long-term stewardship implementation plan).<sup>30</sup>

Site-specific cost information is provided in two appendices:

- Appendix E: Projected Long-Term Stewardship Costs for Sites: 2000, 2006, and 2050, which provides “snapshots” for the years indicated, and
- Appendix F: Projected Annual Average Long-Term Stewardship Costs for Sites: 2000-2010, 2031-2040, and 2061-2070, which provides average annual long-term stewardship costs for each site for each of the time intervals indicated.

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<sup>30</sup> See Memorandum for All Departmental Elements from Deputy Secretary T.J. Glauthier regarding "Long-term Stewardship Transition to Site Landlord", December 15, 2000.

Although similar at first glance, each appendix provides different perspectives in analyzing the data. Appendix E provides the simplest summary of expected costs by providing a "snapshot" of the costs for each site for three critical years -- 2000, 2006, and 2050. However, this method of summarizing cost information could result in a misleading presentation of the site-specific cost information if changes in costs are expected to occur between the "snapshot" years (i.e., between 2000 and 2006 or between 2006 and 2050). For example, if a site initiates long-term stewardship activities after 2006 and completes long-term stewardship activities prior to 2050, the "snapshot" presented in Appendix E of 2006 and 2050 would fail to capture these costs; therefore, average costs, as provided in Appendix F, provides a better perspective. Volume II provides the available detailed cost estimates and the scope of long-term stewardship for each site.<sup>31</sup>

DOE spends a relatively small portion of its current Environmental Management budget on long-term stewardship. To date, DOE's primary focus has been on the "cleanup" of sites – managing wastes and materials until disposition, deactivating/decommissioning unneeded facilities, facility surveillance and maintenance, and other activities to stabilize and close sites. However, as DOE completes cleanup and begins performing long-term stewardship activities at an increased number of sites and portions of sites, the total budget for performing long-term stewardship activities will also increase (although the annual cost will still remain small compared to the current annual cost for cleanup). DOE's preliminary, order-of-magnitude cost estimate indicates that from 2000 to 2070, DOE will spend a total of approximately \$5.5 billion on long-term stewardship activities. For comparison, DOE estimates that high-level waste cleanup costs are anticipated to be more than \$50 billion for the same time period. Although the budget for performing long-term stewardship activities will increase over time, at least in the near-term, the budget increase is primarily due to the number of sites performing activities. Some of the most challenging remediation tasks (e.g., remediating the contamination in high-level radioactive waste tanks and reprocessing canyons) will not be completed until well beyond 2006 and will ultimately require long-term stewardship activities, for which the costs are not yet known.

The highest projected long-term stewardship costs over time are associated with DOE's major sites, such as the Hanford Site, Oak Ridge Reservation, and the Savannah River Site.<sup>32</sup> At these sites, DOE still has complex contamination and remediation challenges ahead, such as co-mingled contaminants in groundwater plumes, unknown extent of subsurface contamination and other technically challenging problems, such as long-term surveillance and maintenance of high-level waste tanks. While it is clear that long-term stewardship will be required at these sites because of existing disposal cells and some other known conditions (e.g., groundwater contamination that will be monitored and contained rather than remediated), the specific activities and associated costs to manage additional activities in the future remain uncertain. Therefore, the estimates for future long-term stewardship costs may be underestimated.

Exhibit 3-5 shows an estimated long-term stewardship cost profile for the period between 2000 and 2070. Between 2004 and 2010, the projected cost increase is primarily due to more sites beginning long-term stewardship activities. Many sites under the DOE Grand Junction Office's management responsibility are expected to begin long-term stewardship activities at this time, along with larger sites, such as the Rocky

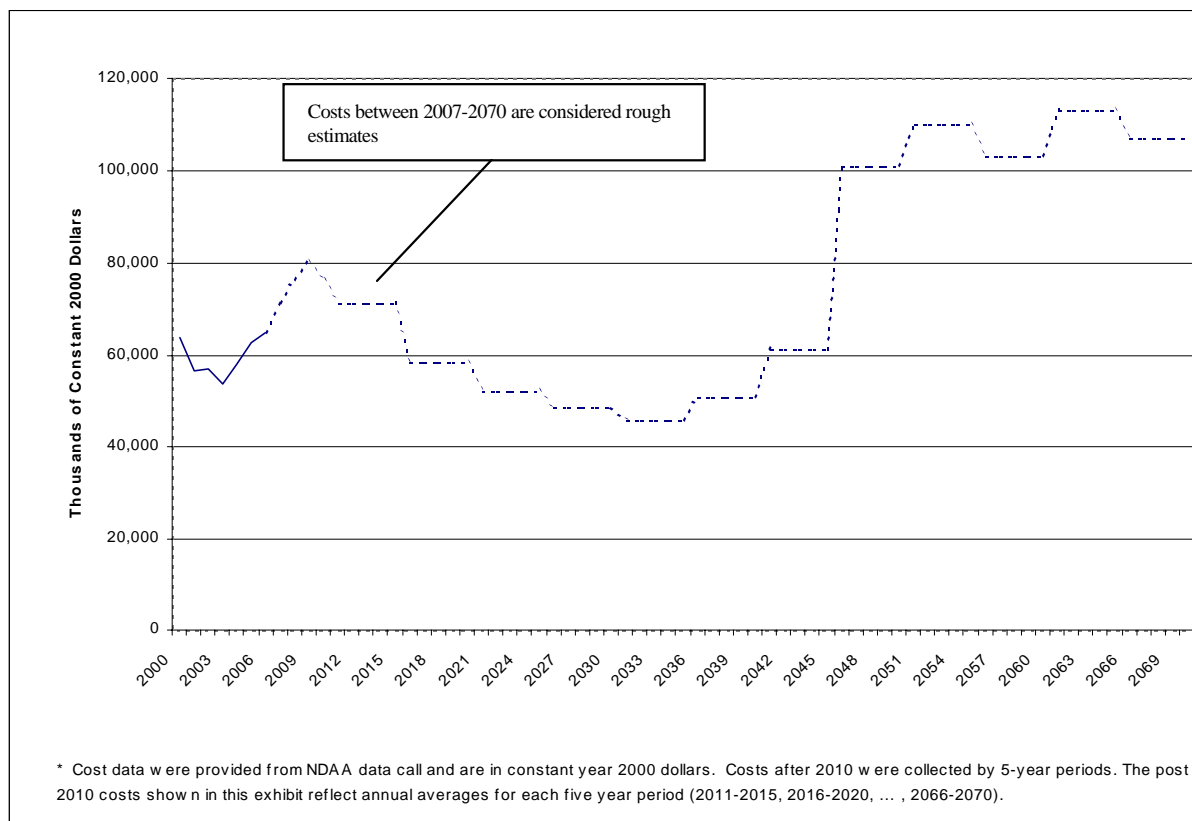
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<sup>31</sup> Currently, for sites where DOE is not responsible for cleanup, but may be responsible for long-term stewardship activities, there is no basis for providing any costs estimates. Therefore, no cost estimates are provided for 21 FUSRAP sites where the U.S. Army Corps of Engineers is managing cleanup and one UMTRCA Title II site (the 11e.(2) Disposal Site in Utah) where a private company is managing operations.

<sup>32</sup> Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and, therefore, reasonably reliable cost estimates were not available to be included in this Report. Hence, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.

Flats Environmental Technology Site. Between 2010 and 2035, long-term stewardship costs are expected to decrease as monitoring programs and pump and treat systems decrease or end. When all remediation activities are completed (between 2045 and 2050) at two major sites (the Hanford Site and the Idaho National Engineering and Environmental Laboratory (INEEL)), the costs are expected to increase sharply as major site activities, such as maintenance and monitoring of high-level waste tanks become long-term stewardship activities.

**Exhibit 3-5. Estimated Annual Long-Term Stewardship Costs**



Costs after FY 2010 were collected by five-year periods and, therefore, the post FY 2010 costs shown in this exhibit reflect annual averages for each five-year period (2011-2015, 2016-2020...2066-2070).

- Between 2010 and 2035, long-term stewardship costs decrease at many sites as monitoring programs and pump and treat systems decrease or end.
- After 2050, long-term stewardship costs are expected to remain relatively constant. However, some fluctuations are expected for sites anticipating possible equipment repair or replacement (e.g., monitoring wells).
- Long-term stewardship cost estimates for the Savannah River Site do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to be an underestimate for the Department's long-term cost obligations.
- The extent of long-term stewardship for the 21 FUSRAP sites transferred to the Corps and two UMTRCA Title II sites are currently unknown. Therefore, cost data for these sites were not included in the estimates above.

### 3.4.1 Near Term Long-Term Stewardship Costs

According to the information compiled from Field offices, the Department currently spends approximately \$64 million per year (as of FY 2000) for long-term stewardship activities at sites (or portions of sites) where cleanup, stabilization, or disposal activities have been completed. This total estimated cost was derived from individual cost estimates provided by 58 individual geographic sites, including 34 sites where all cleanup work has been completed, 12 sites where portions of the site have been cleaned up but where additional cleanup work is occurring elsewhere at the site, and 12 sites where all surface cleanup has been completed but where additional subsurface work remains to be done. Table 3-5 summarizes the expected number of sites requiring long-term stewardship and the anticipated annual long-term stewardship and cleanup costs for 2000, 2006, and 2050.

**Table 3-5. Long-Term Stewardship Cost Highlights**

<i>Year</i>	<i>2000</i>	<i>2006</i>	<i>2050</i>
Expected Number of Sites Requiring Long-Term Stewardship	58 sites <ul style="list-style-type: none"> <li>• 34 entirely complete</li> <li>• 12 “geographically distinct” portions where long-term stewardship is being conducted</li> <li>• 12 sites where surface cleanup is complete, but subsurface characterization/remediation is ongoing</li> </ul>	96 sites <ul style="list-style-type: none"> <li>• 67 sites entirely complete</li> <li>• 12 “geographically distinct” portions complete</li> <li>• 17 sites where surface cleanup is complete by 2006, but site subsurface characterization is ongoing</li> </ul>	129 sites
Projected Annual Long-Term Stewardship Cost <sup>33</sup>	\$64 Million	\$65 Million <sup>34</sup>	\$101 Million <sup>35</sup>
Projected Annual Environmental Management Cost <sup>36</sup>	\$6 Billion	\$6 Billion	\$150 Million <sup>37</sup>

<sup>33</sup> Costs for the 21 FUSRAP sites transferred to the Corps in 1997 were not included in the cost estimates because the extent of long-term stewardship is currently unknown.

<sup>34</sup> While a number of sites do show cost increases between 2000 and 2006, this increase in cost is offset by cost decreases at some sites during this period. These expected decreases in long-term stewardship cost can be attributed to many one-time administrative costs associated with initiations of long-term stewardship activities, as well as termination of groundwater pump and treat activities at some sites.

<sup>35</sup> Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department’s long-term cost obligations.

<sup>36</sup> Cleanup cost data taken from the U.S. Department of Energy Office of Environmental Management’s “Status Report on Paths to Closure,” DOE/EM-0526, March 2000. Environmental Management costs displayed in this table do not include the long-term stewardship costs.

<sup>37</sup> Environmental Management costs in 2050 consist primarily of high-level waste treatment, field programs (e.g., program support), and landlord responsibilities (e.g., maintaining roads).



This current annual estimate is significantly greater than the approximately \$2.8 million budgeted by DOE's Grand Junction Office for long-term stewardship activities at 37 sites (see the text box *Long-Term Surveillance and Maintenance by the Grand Junction Office*). Hence, it is clear that, although DOE's Grand Junction Office performs much of the explicitly identified long-term stewardship activities at sites where cleanup and closure has been completed, a significant amount of long-term stewardship activities is occurring at others sites.

This estimate of current expenditures could either understate or overstate the costs required for long-term stewardship activities following cleanup. The estimate could be understated because many long-term stewardship activities are being performed as part of overall site maintenance work (e.g., site security and groundwater monitoring), now categorized at some sites as "overhead" activities instead of long-term stewardship activities. On the other hand, the estimate may overstate the cost required (not the amount spent) for long-term stewardship in that significant opportunities remain to perform the work more efficiently. For example, some sites may be performing extensive groundwater monitoring at a level that was originally required for site characterization. However, the number of wells monitored and samples analyzed may be reduced for long-term stewardship purposes if initial monitoring has been sufficient to characterize and model the behavior of groundwater contaminant movement, thereby allowing future monitoring to be conducted with fewer wells.

#### **LONG-TERM SURVEILLANCE AND MAINTENANCE BY THE GRAND JUNCTION OFFICE**

Long-term stewardship is not a new issue for the Department. For example, Field staff at the Department's Grand Junction Office (GJO) have been conducting long-term stewardship activities for several years. Originally established during World War II to support uranium mining and assaying, GJO supports the uranium mill tailings remediation program, for which surface cleanup was completed in 1996. GJO manages the long-term surveillance and maintenance program to maintain the physical (e.g., disposal cell cap) and institutional controls (e.g., deed restrictions, fencing and warning signs) that were put in place as each uranium milling site completed surface remediation activities -- and in a few cases, subsurface remediation activities (e.g., groundwater remediation). GJO performs these long-term stewardship activities under the regulatory control of the NRC. Although GJO's long-term stewardship efforts have primarily focused on closed uranium mill tailings sites, GJO has been taking on more responsibility for other types of sites, such as the Pinellas STAR Center in Florida. GJO is currently conducting long-term stewardship activities at 26 sites located primarily in the western U.S.

One of the lessons learned from GJO's experience is the importance of developing a long-term stewardship plan as a baseline for operations. GJO operations also provide a useful source of field-validated costs for long-term stewardship activities.

DOE's estimated annual cost for long-term stewardship in 2006 is approximately \$65 million. This total annual cost estimate was derived from individual estimates provided for 96 individual geographic sites, including 67 sites where all EM work has been completed, 12 sites where portions of the site have been cleaned up but where additional cleanup work is occurring elsewhere at the site, and 17 sites where all surface cleanup has been completed but where additional subsurface work remains to be done. During this same time period, as a comparison, the budget target for EM is expected to remain at \$6 billion per year.

Although this annual estimate for long-term stewardship in 2006 is only slightly higher than the 2000 estimated annual cost, it reflects significant changes within individual costs for long-term stewardship. The lack of a significant overall increase in the estimated annual cost results from substantial cost reductions occurring at several sites, while new long-term stewardship costs are added as a result of the completion of cleanup at 38 additional sites. There are two general reasons why costs for long-term stewardship at some sites are expected to decrease substantially during this period: (1) in some cases, groundwater pump and treat work is characterized as long-term stewardship and is expected to end prior to 2006; and (2) one-time administrative activities (e.g., establishing record-keeping management systems) are expected to be completed prior to 2006 at several sites. Because of these cost reductions at some sites, the net increase in long-term stewardship costs between 2000 and 2006 will be relatively small despite an increase in the

number of sites conducting long-term stewardship activities.

The key issue in estimating costs is establishing the activities required for which costs will be incurred. At this time, reliable information on the scope of long-term stewardship activities is limited, even for the near-term cost estimates, much less the out-year estimates. Significant costs are currently being incurred due to activities such as groundwater pump and treat operations, which in many cases are associated with cleanup rather than long-term stewardship goals. In addition, the costs associated with DOE's Grand Junction Office and other smaller sites already conducting long-term stewardship can be clearly assigned to a variety of functions, including: 1) monitoring and maintaining facilities, engineered caps, and in-situ barriers; 2) access controls and restrictions; 3) routine monitoring and maintenance (i.e., well replacement); and 4) record-keeping and reporting. However, future cost drivers remain unclear because of the preliminary nature of the data received, and because of the uncertain nature of long-term stewardship activities at some of DOE's largest, most complex sites.

### **3.4.2 Out-Year Long-Term Stewardship Costs**

Although the primary focus of this Report is on sites and portions of sites where cleanup, stabilization, and disposal activities are expected to be completed by 2006 (as directed in the FY 2000 NDAA), some out-year activities and preliminary estimated costs are also included, where such information was available for the sites. However, as with other cost estimates for long periods of time in the future, the out-year estimates contained in this Report are somewhat speculative and certainly incomplete in many cases.

Based on out-year estimates submitted by Field offices, the estimated annual cost for long-term stewardship in 2050 is approximately \$100 million. This cost estimate is based on available cost estimates for 129 sites where DOE is expected to be responsible for long-term stewardship. For several sites (e.g., Savannah River Site post-2006 activities and FUSRAP sites currently managed by the U.S. Army Corps of Engineers) no reasonably reliable cost estimates were available. During this same time period, the budget target for EM is expected to remain at \$150 million per year -- primarily for high-level waste treatment, field programs (e.g., program support), and landlord responsibilities (e.g., maintaining roads).

Although this out-year estimate of \$100 million is somewhat speculative and incomplete, the Department believes that it is likely accurate to an order-of-magnitude range (i.e., it is not likely to be \$10 million or \$1 billion per year). Although \$100 million annually for long-term stewardship is substantially less than the \$6 billion currently spent annually on the EM program, it is still a significant cost, particularly when it is expected to be required for a very long period of time. In some cases, cleanup agreements require long-term stewardship in perpetuity. Hence, any amount multiplied by perpetuity equals an infinite sum. The Department is, therefore, seeking to reduce these annual costs further.

Four general factors are expected to affect long-term stewardship costs are: (1) the "end state" selected for cleanup, which is dependent on expected land use, and the technical and economic feasibility of cleanup, (2) standards that must be achieved for the selected land use and end state, (3) the remedial technology selected to achieve the end state and standards, and (4) the scope of activities determined to be appropriate for long-term stewardship (e.g., extent and frequency of monitoring, frequency of remedy replacement, monitoring of health, worker pensions, extent of record-keeping, etc.). Of these factors, the Department has primary control over #3 (technologies used) and #4 (long-term stewardship activities). The Department is seeking to reduce long-term costs through investments in science and technology that could result in more reliable and less costly cleanup and long-term stewardship technologies (e.g., groundwater monitoring). Without such investments in better science and technologies, there is little hope for reducing the long-term costs.

### 3.5 LAND AREA REQUIRING LONG-TERM STEWARDSHIP

Another way to measure the extent of the Department's long-term stewardship responsibility is to estimate the amount of land (versus the number of sites or portions of sites) likely to require use or access restrictions because of hazards associated with residual surface or subsurface contamination. Long-term stewardship of land is required for a number of reasons, including: (1) conservation of natural resources; (2) protection as a safety or security buffer for ongoing operations; (3) contamination of groundwater (often during extended and uncertain pump and treat operations or where monitored natural attenuation is occurring); (4) maintenance of engineered units (e.g., closed disposal cells and capped landfills); and (5) contamination of soil that remains on the surface or the accessible subsurface.<sup>38</sup> This section only discusses the amount of land anticipated to require long-term stewardship activities at the 129 sites where DOE expects to perform long-term stewardship.<sup>39, 40</sup>

#### DOE LAND HOLDINGS

From the Manhattan Project to the present, DOE and its predecessor agencies acquired sizeable tracts of land to build and operate infrastructures needed to support nuclear weapons production activities, manage the resulting wastes and materials, and provide buffer space to maintain security and protect the public. Land area acquired by DOE for the nuclear weapons complex grew to approximately 2.54 million acres of land – an area approximately the size of the States of Rhode Island and Delaware combined. DOE still retains nearly all of this land. Most of the land held by DOE today is clean (approximately 79 percent) and has never been contaminated. In fact, one paradox of the Cold War is, because of the exclusion of commercial development for security and state reasons, many DOE sites are ecologically pristine, harboring native vegetation, and endangered species.

The land area requiring long-term stewardship largely depends on the extent of soil contamination and the spatial extent of groundwater contamination, but also includes surface areas for engineered units, even though engineered units comprise a relatively small area. Land area requiring long-term stewardship is not merely the sum of different areas of contamination. In some cases, areas can overlap with one another (e.g., surface contamination overlapping a groundwater plume); therefore, contaminated areas should be evaluated in three-dimensional space. Traditional land conservation areas and safety/security buffers are not considered as land requiring long-term stewardship and, therefore, are outside the scope of this Report. Instead, this Report to Congress focuses on lands with use restrictions resulting from residual contamination. For more detail on the methodology for determining land area requiring long-term stewardship, see Appendix C, Section 7.

To develop the estimates provided in this section, DOE used information in addition to the initial survey of Field offices, which served as the primary information source for this Report. These other sources included

<sup>38</sup> DOE has contributed to the conservation of ecological systems both purposely and inadvertently. In many cases, vast tracts of land have been restricted from development for security reasons and, paradoxically, are ecologically rich and diverse. Many areas have become habitat for endangered species amidst profound radioactive contamination. More recently, the Department has deliberately sought to protect a number of tracts of land (e.g., the Rock Creek Preserve at the Rocky Flats Environmental Technology Site, and the Arid Lands Ecology Area and the Wahluke Slope section of the Hanford Site). These areas of the Hanford Site were designated as a national monument by President Clinton under the Antiquities Act in June 2000.

<sup>39</sup> This section focuses mainly on land in terms of surface soil contamination. In some cases, it does include discussion of land areas where contaminated groundwater is the only driver for long-term stewardship activities. However, comprehensive data were not available at the time of this Report to allow an estimate of the amount of land that will be affected by the extent of contaminated groundwater plumes.

<sup>40</sup> The land area represented by the 129 sites included in this analysis accounts for approximately 2.1 million of the 2.54 million acres under DOE responsibility. The extent of long-term stewardship is yet to be determined for the 21 FUSRAP sites transferred to the Corps for remediation; therefore, the land area analysis does not include these sites.

site-specific Environmental Impact Statements and land use reports. The specific methodology and data sources used to develop the estimate in this discussion is provided in Appendix C - Methodology.

Of the 2.54 million acres under DOE's responsibility, DOE expects to perform long-term stewardship activities at approximately 0.54 million acres which is approximately 21 percent of the total land under DOE responsibility.<sup>41</sup> Depending on the nature of the remaining hazards, long-term stewardship will include activities such as monitoring, record-keeping, and land use restrictions.

DOE estimates that just over 2.0 million out of the total 2.54 million acres (approximately 79 percent of the land under its responsibility) is "clean" and not contaminated by radioactive or hazardous chemical releases.<sup>42</sup> Most of the 2.0 million acres were never contaminated. However, some of the 2.0 million acres were contaminated lands that have been cleaned up to levels appropriate for residential use. Of the 2.0 million acres of uncontaminated land, DOE will eventually release some of the land for other uses, and some will be retained by DOE as buffer zones or to support other missions. A small percentage of currently contaminated land may be cleaned up to levels accepted for unrestricted use. However, given the nature of contamination and, in some cases, technological restraints, the vast majority of contaminated lands will require some form of long-term stewardship.

Exhibits 3-6 and 3-7 show the number of acres where DOE expects to perform long-term stewardship over time in relation to the current total DOE land holdings.

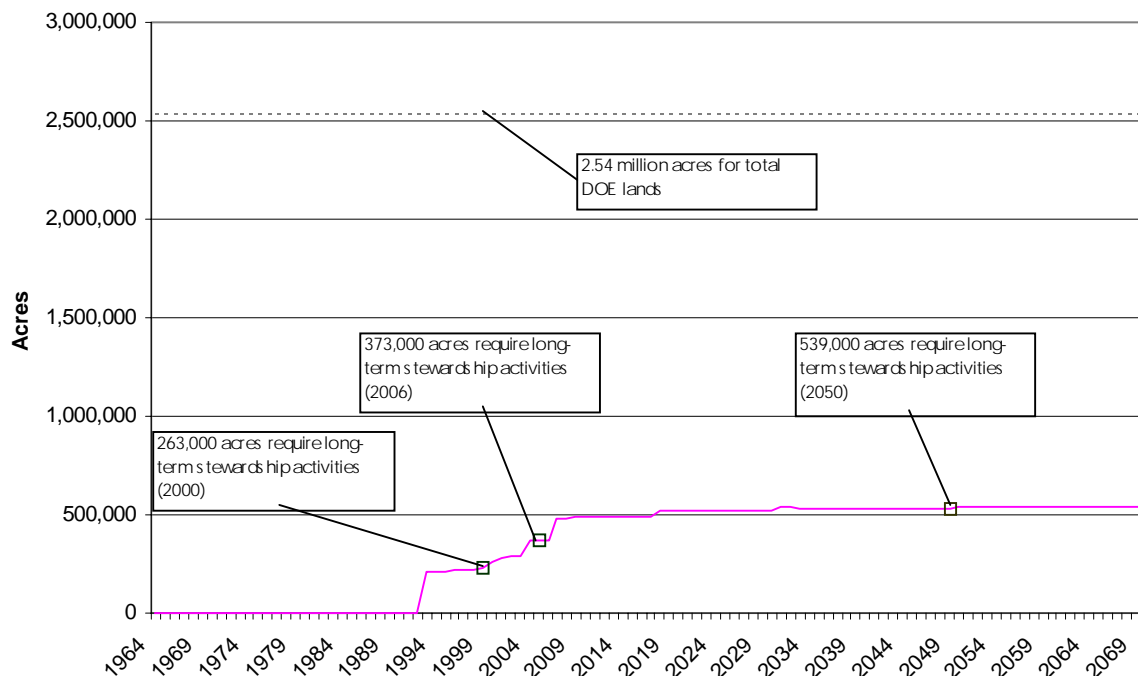
- In 2000, the number of acres where DOE is performing long-term stewardship activities is approximately 10 percent of the total acres, or 263,000 acres. More specifically, at almost half (263,000 acres) of all contaminated lands (0.54 million acres or 539,000 acres), DOE has completed cleanup activities and is conducting long-term stewardship activities.
- By 2006, DOE expects to cleanup and conduct long-term stewardship activities at almost 70 percent (373,000 acres) of all contaminated lands (0.54 million acres or 539,000 acres).
- Between 2006 and 2050, DOE anticipates performing long-term stewardship activities at several additional sites and portions of sites. By 2050, DOE anticipates that all contaminated lands (0.54 million acres or 539,000 acres) will be cleaned up and will require long-term stewardship activities.

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<sup>41</sup> Approximately 210,000 acres are associated with a 1940s bombing and artillery range within what is now the Idaho Engineering and Environmental National Laboratory.

<sup>42</sup> For the purpose of this Report, this estimate includes approximately 195,000 acres designated as a national monument at the Hanford site in June 2000.

### Exhibit 3-6. DOE Expects to Perform Long-Term Stewardship at More than 21 Percent of DOE's Current Land Holdings



- As previously discussed, portions were partly defined to follow long-term stewardship boundaries, but this was not the case for all defined portions. In cases where defined portions are significantly larger than the area of residual contamination, acreage was based upon the area defined by media contamination. For the Hanford Site, acreage was changed for the defined portions (Wahluke Slope, Arid Land Ecology Reserve, and the Riverlands) to show the extent of media contamination. The combined, total long-term stewardship acreage for the three portions is assumed to be 510 acres.
- Idaho National Engineering and Environmental Laboratory's (INEEL) Ordnance Area is the single largest contiguous area subject to long-term stewardship, covering nearly 210,000 acres.
- Because the NDAA Conference Report only requested information on sites or portions of sites where remediation activities are complete and long-term stewardship begins by 2006, some sites with large land holdings and ongoing remediation were not required to provide all of their forecasted long-term stewardship acreage. For three of these sites (INEEL, the Savannah River Site, and the Nevada Test Site), the NDAA Data Call significantly underestimated life-cycle long-term stewardship acreage. Therefore, additional data sources were used to estimate long-term stewardship acreage.
  - For calendar year 2017, 23,000 acres were inserted for the Nevada Test Site (NTS) to fully account for surface plutonium contamination [if regulatory limits are 1000 picocuries per gram (PiCu/g)] not captured in this Report to Congress.<sup>1</sup> Note that inclusion of 23,000 acres is only for estimating purposes. NTS and the Air Force have not yet reached agreement on a cleanup level.
  - For calendar year 2030, 21,000 acres were inserted for the Savannah River Site to fully account for the contaminated right of way, industrial use, and ponds not captured in the NDAA Data Call.<sup>2</sup>
  - For calendar year 2050, 10,000 acres were inserted for INEEL to account for planned environmentally controlled areas not captured in this Report to Congress.<sup>3</sup>
- Information outside of the NDAA Conference Report request was used to create long-term stewardship acreage estimates for large sites scheduled to close well after 2006 (Idaho National Engineering and Environmental Laboratory, Nevada Test Site, and the Savannah River Site).
- The extent of land that will require long-term stewardship at the 21 FUSRAP sites that were transferred to the Corps is currently unknown. Therefore, the acreage of these sites were not included in the above acreage estimates.

<sup>1</sup> "Cost/Risk/Benefits Analysis of Alternative Clean-up Requirements for Plutonium Contaminated Soils on and Near the Nevada Test Site."

DOE/NV-399, May 1995.

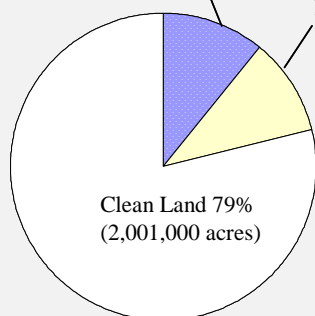
<sup>2</sup> Data for the Savannah River Site are based on the assumption that five percent of the site acreage is developed and will require access restrictions.

<sup>3</sup> The Idaho National Engineering and Environmental Laboratory Land Use Plan (1996).

**Exhibit 3-7. Comparing Long-Term Stewardship Acreage Over Time****2000**

DOE is expecting to conduct long-term stewardship in the future 11% (276,000 acres)

DOE is currently conducting long-term stewardship 10% (263,000 acres)

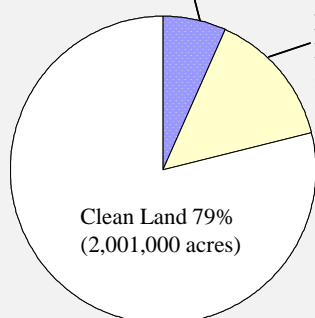


- Nearly 21% of DOE land is contaminated and falls into one of two categories: (1) contaminated land with ongoing remediation (scheduled for long-term stewardship), or (2) land currently subject to long-term stewardship.
- As of 2000, 34 sites have completed remediation and are subject to long-term stewardship, covering approximately 263,000 acres (10%).
- Roughly 79% of all DOE land is clean. Most of this land has always been uncontaminated, while some has been remediated for unrestricted use.
- The largest single area subject to long-term stewardship is the Ordnance Area at the Idaho National Engineering and Environmental Laboratory, which accounts for nearly 210,000 acres.

**2006**

DOE is expecting to conduct long-term stewardship in the future 6% (166,000 acres)

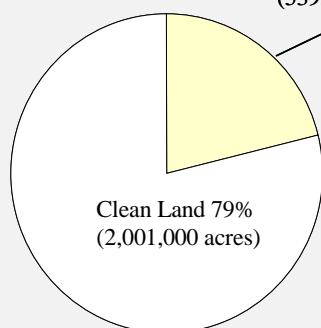
DOE is currently conducting long-term stewardship 15% (373,000 acres)



- By 2006, 96 of the 129 sites are expected to be conducting long-term stewardship activities, covering approximately 373,000 acres (15%).
- Twenty-nine of the 96 sites will only be conducting long-term stewardship activities at portions of the site where remediation has been completed. Seventeen of these sites will have surface remediation completed but will have ongoing subsurface characterization.
- Contaminated lands scheduled to eventually require long-term stewardship will continue to be remediated at many of the larger sites.

**Post 2050**

DOE is currently conducting long-term stewardship 21% (539,000 acres)



- By 2050, 129 sites may be subject to long-term stewardship, covering approximately 539,000 acres (21%).
- Idaho National Engineering and Environmental Laboratory and Hanford are the last two sites scheduled to complete site-wide remediation (2050 and 2046 respectively).
- The overall acreage subject to long-term stewardship is expected to remain relatively constant between 2050 and 2070. Only small sites and small portions of larger sites, which represent a small percentage of overall DOE long-term stewardship acreage, are scheduled to complete long-term stewardship commitments during this period.

### 3.6 WHO WILL BE INVOLVED IN PERFORMING LONG-TERM STEWARDSHIP?

To gain get a better understanding of the level of involvement of various entities in performing long-term stewardship activities, DOE analyzed four types of site involvement.

- **Owner** - Entity who owns the deed to the property. In some instances, the owner leases the property to someone else, known as a landlord.
- **Landlord** - Entity responsible for activities that involve the physical operation and maintenance of installations. Specific tasks vary but generally include providing utilities, maintenance, and general infrastructure for the entire installation.
- **Steward** - Individuals or groups responsible for performing and/or ensuring that the required long-term stewardship activities take place.
- **Funding Organization** - Agency which provides financial support for stewardship activities.

As illustrated in Table 3-6, DOE is frequently not the owner or landlord of the property where it is or will be conducting long-term stewardship activities. In fact, at 64 sites where DOE is (or will be) performing long-term stewardship activities, DOE is working with other entities (e.g., Federal non-DOE, State, local, and private) to ensure that the necessary activities take place. At these sites, DOE works with the entities to coordinate long-term stewardship activities, such as surveillance and maintenance of facilities, monitoring of groundwater, and enforcing institutional controls. At the Pinellas STAR Center in Florida, for example, DOE is responsible for funding the long-term stewardship activities, but site ownership has already been transferred to a private entity.

Local governments traditionally conduct and enforce land use planning, land use restrictions (e.g., zoning) and certain types of record-keeping (e.g., deed registration), regardless of whether land is owned by Federal or private entities.

However, at 57 sites, DOE is the steward, funding organization, owner, and landlord. Currently, the responsibility for long-term stewardship resides with a variety of DOE offices, depending on the site and the situation. The exception is 11 sites (e.g., the Maxey Flats Disposal Site), where DOE has been responsible for at least some of the cleanup costs but does not expect to have any long-term stewardship responsibility.<sup>43</sup> For most of the larger sites, where long-term stewardship and cleanup activities are occurring concurrently (e.g., the Hanford and Savannah River Sites), long-term stewardship activities are considered part of the overall infrastructure and maintenance duties of their managing DOE operations office. For a number of sites, where cleanup has been completed, DOE conducts and funds a variety of long-term stewardship activities. For example, DOE is responsible for all aspects of long-term stewardship activities, including funding, for the UMTRCA Title II sites (e.g., (Homestake) Grants Site). However, the private owner of the site must make a one-time payment to the U.S. Treasury, in accordance with NRC rules, that pays for long-term stewardship activities at the site.

The distribution of responsibilities for performing long-term stewardship activities will change over time as property is transferred to and from DOE. In some instances, DOE can transfer property available for restricted use to other Federal or non-Federal entities. These property transfers often occur when neighboring communities want to use the land for economic redevelopment, and the risks associated with residual hazards are consistent with the anticipated redevelopment. DOE may retain responsibility for portions of long-term stewardship activities, impose management or use restrictions on the transferred property (stated in the land transfer documents), and/or oversee any restrictions or limits that are imposed.

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<sup>43</sup> Long-term stewardship responsibilities for the West Valley Demonstration Project are yet to be determined.



Table 3-6. Long-Term Stewardship Responsibility

State	Site Name	Responsibility			
		Steward	Funding Organization	Owner	Landlord
Alaska	Amchitka Island	DOE	DOE	Federal Non-DOE	Federal Non-DOE
Arizona	Monument Valley Site <sup>a</sup>	DOE	DOE	Tribe	N/A
	Tuba City Site <sup>a</sup>	DOE	DOE	Tribe	N/A
California	Energy Technology Engineering Center <sup>b</sup>	Private	Private	Private	Private
	General Atomics <sup>b</sup>	Private	Private	Private	Private
	General Electric Vallecitos Nuclear Center <sup>b</sup>	Private	Private	Private	Private
	Laboratory for Energy-Related Health Research Site <sup>b</sup>	UC/State	UC/State	UC/State	UC/State
	Lawrence Berkeley National Laboratory	DOE	DOE	State	DOE
	Lawrence Livermore National Laboratory - Livermore Site	DOE	DOE	DOE	DOE
	Lawrence Livermore National Laboratory - Site 300	DOE	DOE	DOE	DOE
	Sandia National Laboratories - CA	DOE	DOE	DOE	DOE
	Stanford Linear Accelerator	DOE	DOE	Private	DOE
Colorado	Bodo Canyon Cell <sup>a</sup>	DOE	DOE	DOE	N/A
	Burro Canyon Disposal Cell <sup>a</sup>	DOE	DOE	DOE	N/A
	Cheney Disposal Cell <sup>a</sup>	DOE	DOE	DOE	N/A
	(Cotter) Cañon City Site <sup>a, d</sup>	DOE	DOE	DOE	N/A
	Durango Mill <sup>a</sup>	DOE	DOE	State	N/A
	Estes Gulch Disposal Cell <sup>a</sup>	DOE	DOE	DOE	N/A
	Fort St. Vrain	DOE	DOE	DOE	DOE
	Grand Junction Mill <sup>a</sup>	DOE	DOE	Other	N/A
	Grand Junction Mill 2 <sup>a</sup>	DOE	DOE	DOE	N/A
	Gunnison Disposal Cell <sup>a</sup>	DOE	DOE	DOE	N/A
	Gunnison Mill <sup>a</sup>	DOE	DOE	Other	N/A
	(HECLA) Durita Site <sup>a, b</sup>	DOE	DOE	Private	N/A
	Maybell Mill Site <sup>a</sup>	DOE	DOE	DOE	N/A
	Naturita Mill <sup>a</sup>	DOE	DOE	Private/ Other	N/A
	Naturita Site <sup>a</sup>	DOE	DOE	DOE	N/A
	Naval Oil Shale Reserves Site	DOE	DOE	DOE	Federal Non-DOE
	Rifle (New) Mill <sup>a</sup>	DOE	DOE	Other	N/A <sup>e</sup>
	Rifle (Old) Mill <sup>a</sup>	DOE	DOE	Other	N/A <sup>e</sup>

Table 3-6. Long-Term Stewardship Responsibility

State	Site Name	Responsibility			
		Steward	Funding Organization	Owner	Landlord
	Rio Blanco	Federal Non-DOE	DOE	Federal Non-DOE	Federal Non-DOE
	Rocky Flats Environmental Technology Site	Other	DOE	DOE	DOE
	Rulison	Other	DOE	Private	Private
	Slick Rock (North Continent) Mill 1 <sup>a</sup>	DOE	DOE	Private	N/A
	Slick Rock (Union Carbide) Mill 2 <sup>a</sup>	DOE	DOE	Private	N/A
	(UMETCO) Maybell Site 2 <sup>a, d</sup>	DOE	DOE	Private	N/A
	(UMETCO) Uravan Site <sup>a, d</sup>	DOE	DOE	DOE	N/A
Connecticut	CE <sup>c</sup>	Yet to be determined			
Florida	Pinellas STAR Center	Private	DOE	Other	DOE
Idaho	Idaho National Engineering and Environmental Laboratory	DOE	DOE	DOE	DOE
	Lowman Site	DOE	DOE	DOE	DOE
Illinois	Argonne National Laboratory East	DOE	DOE	DOE	DOE
	Fermi National Accelerator Laboratory	DOE	DOE	DOE	DOE
	Madison <sup>c</sup>	Yet to be determined			
	Palos Forest (Site A/Plot M) Preserve	DOE	DOE	Other	DOE
Iowa	Ames Laboratory	No activities beyond record-keeping expected			
Kentucky	Maxey Flats Disposal Site <sup>b</sup>	State	State	State	State
	Paducah Gaseous Diffusion Plant	DOE	DOE	DOE	DOE
Maryland	W.R. Grace and Company <sup>c</sup>	Yet to be determined			
Massachusetts	Shpack Landfill <sup>c</sup>	Yet to be determined			
Mississippi	Salmon Site	Other	DOE	State	State
Missouri	Kansas City Plant	DOE	DOE	DOE	DOE
	Latty Avenue Properties <sup>c</sup>	Yet to be determined			
	St. Louis Airport Site <sup>c</sup>	Yet to be determined			
	St. Louis Airport Site Vicinity Properties <sup>c</sup>	Yet to be determined			
	St. Louis Downtown Site <sup>c</sup>	Yet to be determined			
	Weldon Spring Site	DOE	DOE	DOE	DOE
	Westlake Disposal Site <sup>b</sup>	Yet to be determined			
Nebraska	Hallam Nuclear Power Facility	DOE	DOE	Other	DOE
Nevada	Central Nevada Test Area	Federal Non-DOE	DOE	Federal Non-DOE	Federal Non-DOE
	Nevada Test Site	DOE	DOE	Federal Non-DOE	DOE
	Project Shoal	Federal Non-DOE	DOE	Federal Non-DOE	Federal Non-DOE

Table 3-6. Long-Term Stewardship Responsibility

State	Site Name	Responsibility			
		Steward	Funding Organization	Owner	Landlord
New Jersey	DuPont & Company <sup>e</sup>	Yet to be determined			
	Maywood Chemical Works <sup>e</sup>	Yet to be determined			
	Middlesex Sampling Plant <sup>e</sup>	Yet to be determined			
	Princeton Plasma Physics Laboratory	DOE	DOE	Other	DOE
	Wayne Site <sup>e</sup>	Yet to be determined			
New Mexico	Ambrosia Lake Site	DOE	DOE	DOE	N/A
	Bayo Canyon	DOE	DOE	Private	DOE
	Bluewater Site <sup>d</sup>	DOE	DOE	DOE	N/A
	Gasbuggy Site	Federal Non-DOE	DOE	Federal Non-DOE	Federal Non-DOE
	Gnome-Coach	Federal Non-DOE	DOE	Federal Non-DOE	Federal Non-DOE
	(Homestake) Grants Site <sup>a,d</sup>	DOE	Private	Private	N/A
	Los Alamos National Laboratory	DOE	DOE	DOE	DOE
	Lovelace Respiratory Research Institute	DOE	DOE	DOE	DOE
	(Quivira) Ambrosia Lake Site 2 <sup>a, d</sup>	DOE	Private	Private	N/A
	Sandia National Laboratories - NM	DOE	DOE	DOE	DOE
	Shiprock Site	DOE	DOE	Other	N/A
	(SOHIO) LBAR Site <sup>a, d</sup>	DOE	DOE	Private	N/A
	South Valley Superfund Site <sup>b</sup>	Private	Private	Private	Private
	(UNC) Church Rock Site <sup>b</sup>	DOE	Private	Private	N/A
	Waste Isolation Pilot Plant	DOE	DOE	DOE	DOE
New York	Ashland Oil #1 <sup>e</sup>	Yet to be determined			
	Ashland Oil #2 <sup>e</sup>	Yet to be determined			
	Bliss and Laughlin Steel <sup>e</sup>	Yet to be determined			
	Brookhaven National Laboratory	DOE	DOE	DOE	DOE
	Colonie <sup>e</sup>	Yet to be determined			
	Linde Air Products <sup>e</sup>	Yet to be determined			
	Niagara Falls Storage Site <sup>e</sup>	Yet to be determined			
	Seaway Industrial Park <sup>e</sup>	Yet to be determined			
	West Valley Demonstration Project <sup>b, 44</sup>	TBD	State	State	TBD
Ohio	Ashtabula Environmental Management Project <sup>b</sup>	Private	DOE/Private	Private	Private
	Battelle Columbus-King Avenue <sup>b</sup>	Private	DOE/Private	Private	Private

<sup>44</sup> The funding is 90 percent DOE, 10 percent State. The steward and the landlord have yet to be determined due to the ongoing negotiations. However, the State of New York is the current owner of the site.

Table 3-6. Long-Term Stewardship Responsibility

State	Site Name	Responsibility			
		Steward	Funding Organization	Owner	Landlord
	Battelle Columbus-West Jefferson <sup>b</sup>	Private	DOE/Private	Private	Private
	Fernald Environmental Management Project	DOE	DOE	DOE	DOE
	Luckey <sup>e</sup>	Yet to be determined			
	Miamisburg Environmental Management Project	DOE	DOE	Private	Private
	Painesville <sup>e</sup>	Yet to be determined			
	Piqua Nuclear Power Facility	DOE	DOE	DOE	DOE
	Portsmouth Gaseous Diffusion Plant	DOE	DOE	DOE	DOE
Oregon	Lakeview Mill <sup>a</sup>	DOE	DOE	Private	N/A
	Lakeview Site <sup>a</sup>	DOE	DOE	DOE	N/A
Pennsylvania	Burrell Site <sup>a</sup>	DOE	DOE	DOE	N/A
	Canonsburg Site <sup>a</sup>	DOE	DOE	DOE	N/A
Puerto Rico	Center for Energy and Environmental Research	DOE	DOE	Private	DOE
South Carolina	Savannah River Site	DOE	DOE	DOE	DOE
South Dakota	Edgemont Site <sup>a,d</sup>	DOE	DOE	DOE	N/A
Tennessee	Oak Ridge Reservation	DOE	DOE	DOE	DOE
Texas	(Chevron) Panna Maria Site <sup>a,d</sup>	DOE	DOE	Private	N/A
	(Conoco) Conquista Site <sup>a,d</sup>	DOE	DOE	Private	N/A
	(Exxon) Ray Point Site <sup>a,d</sup>	DOE	DOE	Private	N/A
	Falls City Site <sup>a</sup>	DOE	DOE	DOE	N/A
	Pantex Plant	DOE	DOE	DOE	DOE
Utah	(Atlas) Moab Mill <sup>a, d, f</sup>	DOE	Other	Other	N/A
	(EFN) White Mesa Site <sup>a,d</sup>	DOE	Private	Private	N/A
	Green River Site <sup>a</sup>	DOE	DOE	DOE	N/A
	Mexican Hat Site <sup>a</sup>	DOE	DOE	Other	N/A
	Monticello Mill Site and Vicinity Properties <sup>a</sup>	DOE	DOE	DOE/Other	N/A
	(Plateau) Shootaring Canyon Site <sup>a,d</sup>	DOE	Private	Private	N/A
	(Rio Algom) Lisbon Valley Site <sup>a,d</sup>	DOE	Private	Private	N/A
	Salt Lake City Mill <sup>a</sup>	DOE	DOE	Other	N/A
	South Clive Disposal Cell <sup>a</sup>	DOE	DOE	DOE	N/A
	11e.(2) Disposal Site	Yet to be determined			
Washington	(Dawn) Ford Site <sup>a,d</sup>	DOE	Private	Private	N/A
	Hanford Site	DOE	DOE	DOE	DOE
	(WNI) Sherwood Site <sup>a,d</sup>	DOE	DOE	Other	N/A

Table 3-6. Long-Term Stewardship Responsibility

State	Site Name	Responsibility			
		Steward	Funding Organization	Owner	Landlord
West Virginia	Parkersburg Site	DOE	DOE	DOE	DOE
Wyoming	(ANC) Gas Hills Site <sup>a,d</sup>	DOE	DOE	Private	N/A
	(Exxon) Highlands Site <sup>a,d</sup>	DOE	DOE	Private	N/A
	Hoe Creek Underground Coal Gasification Site	DOE	DOE	Federal Non-DOE	DOE
	(Kennecott) Sweetwater Site <sup>a,d</sup>	DOE	Private	Private	N/A
	Naval Petroleum Reserve No. 3 Landfill/Landfarm	DOE	DOE	DOE	DOE
	(Pathfinder) Lucky Mc Site <sup>a,d</sup>	DOE	DOE	DOE	N/A
	(Pathfinder) Shirley Basin Site 2 <sup>a,d</sup>	DOE	DOE	DOE	N/A
	(Petrochemicals) Shirley Basin Site 1 <sup>a,d</sup>	DOE	DOE	DOE	N/A
	Riverton Site <sup>a</sup>	DOE	DOE	Private	N/A
	Rock Springs Oil Shale Retort Site	DOE	DOE	Private	DOE
	Spook Site <sup>a</sup>	DOE	DOE	DOE	N/A
	(UMETCO) Gas Hills Site <sup>a,d</sup>	DOE	DOE	DOE	N/A
	(Union Pacific) Bear Creek Site <sup>a,d</sup>	DOE	DOE	DOE	N/A
	(WNI) Split Rock Site <sup>a,d</sup>	DOE	DOE	DOE	N/A

<sup>a</sup> For UMTRCA Title I and II sites, the Long-Term Surveillance and Maintenance (LTSM) program is the only ongoing program at these sites; therefore, activities which would otherwise be considered “landlord” responsibilities fall under the auspices of the LTSM program. In addition to specific long-term stewardship activities, the LTSM program will be responsible for maintaining roads, maintenance planning/management, and other basic responsibilities, as needed.

<sup>b</sup> At these sites, a non-DOE entity is responsible for long-term stewardship. However, in some cases, funding, remediation, and long-term stewardship responsibilities for DOE and all other responsible parties are still undetermined.

<sup>c</sup> The United States has title to the land and DOE has administrative jurisdiction.

<sup>d</sup> With the exception of the Edgemont Site and the Bluewater Site, all UMTRCA Title II sites are privately owned. Reclamation activities at these sites are funded by the owner with some reimbursement provided by DOE. The landlord at the Title II sites is the private owner. The steward is not yet known for all of these sites because the extent of long-term stewardship is yet to be determined. However, it is assumed that these sites will eventually be transferred to DOE, at which time DOE will become the steward.

<sup>e</sup> The extent of long-term stewardship activities at 21 FUSRAP sites is currently unknown. Although some of these sites may be cleaned up to unrestricted use and may only require record-keeping activities, for the purpose this Report, all 21 sites are categorized along with 11 additional sites where DOE may be responsible for long-term stewardship activities (see Section 3.2).

<sup>f</sup> Currently, the Trustee is the funding organization and owner. The Trustee will relinquish all responsibility, including funding, to DOE within one year of enactment of the NDAA for FY 2001.



**Low-Level Waste Vault.** This vault at the Savannah River Site is used for storing low-level waste and contains 12 large cells, each 55 feet long, 150 feet wide, and 30 feet high. This vault replaces the previous waste management practice of burying low-level waste in shallow engineered trenches. Workers began storing waste in this vault in September 1994. Once it is full, it will be covered with clay, gravel, and a geotextile cap. These vaults will require environmental monitoring, institutional controls, and long-term surveillance and maintenance in perpetuity. E Area Vault, Solid Waste Management Division. *Savannah River Site, South Carolina, January 1994.*



**Planning for cleanup at the T Plant reprocessing “canyon” at Hanford.** Engineers work on methods for decontaminating and eventually dismantling the world’s oldest plutonium-separation plant. In the meantime, the facilities at the T Plant are being used to decontaminate equipment with high-activity contamination. *Hanford Site, Washington. July 11, 1994.*

## Chapter 4

Next Steps





## CHAPTER 4: NEXT STEPS

DOE needs to transition from a current mission of active cleanup and stabilization to one of its future missions -- that of long-term care of and monitoring at residually contaminated sites. Throughout this shift, the goal of DOE will remain the same -- to protect human health and the environment. This chapter discusses several areas where next steps can be taken to provide a clear path forward for implementing long-term stewardship at DOE sites and establishing the long-term stewardship program. It does not presume to provide the answers or specific recommendations, but rather to raise issues that will need to be addressed in the near-term, as well as concepts that will need to be considered for future long-term stewardship success. Regardless of the next steps taken, it is clear that all discussions and planning activities need to involve close interaction with local officials and land use planners, State regulators, Tribal governments, other Federal agencies, and stakeholders. To be successful, the Department will need to rely on support and active participation from all of these entities to enforce site long-term stewardship controls. Therefore, frequent and early communication regarding all aspects of long-term stewardship planning and implementation will be essential.

In five-to-ten years, ongoing cleanup work at most of the sites will be completed and will likely be succeeded by a long-term stewardship program. At the larger sites, where cleanup is not anticipated to be complete for many years, the transition from remediation to long-term stewardship may be equally significant, but less noticeable, because it will be reflected by the number of portions of sites at which cleanup is complete and long-term stewardship can begin. A reliable and cost-effective long-term stewardship program will undertake whatever work is required to protect human health and the environment after cleanup, stabilization, or disposal is complete (e.g., monitoring, surveillance, maintenance, repair of remedies, performance evaluation, and information management). In addition, the long-term stewardship program will verify that land use and institutional controls are operating effectively to ensure that the land is used or conserved in a safe manner.

DOE is already performing long-term stewardship at many sites and portions of sites where remediation activities are complete. The DOE Grand Junction Long-Term Surveillance and Maintenance Program currently maintains caps, fences, and signs and performs required groundwater and other monitoring (e.g., groundwater and facilities) for 26 sites. At sites where remediation activities are complete for portions of the site, long-term stewardship activities are typically performed as part of ongoing site surveillance and monitoring, facility infrastructure maintenance, or other site-wide functions (except for long-term stewardship activities performed by the Grand Junction Office). However, these sites do not have a program specifically designated to address/perform long-term stewardship as a discrete function. For now, this approach is working to maintain protection of human health and the environment.

At a number of sites, including nine sites now under the National Nuclear Security Administration for nuclear weapons activities (e.g. Los Alamos National Laboratory, Sandia National Laboratories, Lawrence Livermore National Laboratory, and Pantex) and several sites where scientific research will continue, as well as a few large sites (e.g., the Hanford Site, Idaho National Engineering and Environmental Laboratory, and Savannah River Site) where long-term DOE missions will continue for decades, the complete long-term stewardship requirements will depend on the final site cleanup, the contamination present when the missions are complete, and other related factors.

More long-term stewardship information is available for those sites that are closer to completing remediation activities than for other sites. For sites where long-term stewardship activities are not expected to be initiated in the near future (i.e., in the next five years), a delay in planning may be appropriate. Cleanup decisions are still pending and, in many cases, the technical remediation challenges will prolong cleanup activities for years to come. In this case, delaying site-wide long-term stewardship decisions and activities until the end state is better defined will allow site personnel to benefit from lessons learned from other sites and will allow

them to evaluate decisions to make sure that the long-term stewardship implications of those decisions are understood.

However, there are 96 sites or portions of sites where cleanup activities will be complete or partially complete (portions complete) by 2006 and where DOE expects to perform long-term stewardship. There is a clear need now to identify critical activities and the means for transitioning these sites into a long-term stewardship program. Mechanisms are needed to facilitate a seamless transition from the cleanup phase to long-term stewardship and to put in place templates that will ensure a consistent approach to critical activities such as record-keeping and data management. Lessons learned from long-term stewardship at early participation sites will help lay the groundwork for a seamless long-term stewardship program capable of managing the expanding workload as the Department's larger sites complete cleanup.

DOE's focus will need to move from identifying and implementing active remedies to identifying ways to provide cost-effective, adequate protection in the long term. This must be accomplished while seeking to identify science and technologies that can ultimately reduce DOE's costs and liabilities and allow for a wider range of uses at the sites.

#### **4.1 ROLES AND RESPONSIBILITIES FOR LONG-TERM STEWARDSHIP**

The roles and responsibilities for organizations involved with long-term stewardship are still being defined. Even so, it is clear that DOE needs to continue building on this initial framework to identify roles and responsibilities for Field personnel, their contractors, local governments, land users, community planners, Tribal governments, and other interested parties. Currently, many long-term stewardship planning activities are being conducted by personnel who are responsible for a variety of environmental activities at the sites, only one of which is long-term stewardship. As a consequence, it is not clear that there is a consistent approach to evaluating pending decisions to identify potential impacts on the Department's long-term liabilities, or for identifying common long-term stewardship issues and needs that occur at multiple sites. Identifying a person/office responsible for ensuring a smooth transition from cleanup to closure and stewardship would help ensure that critical activities (e.g., defining the end state) are identified and addressed by the staff most knowledgeable about anticipated long-term stewardship needs.

As DOE learns more about long-term stewardship requirements and their costs, it improves its ability to avoid or minimize these costs. Clearly, long-term stewardship reflects an inability to fully remediate, at a reasonable cost, all contamination occurring as a result of operations usually occurring years ago. Comparable operations are now underway or are being designed or constructed (e.g., vitrification facilities and pit production and inspection facilities). It is not yet clear whether those facilities are being constructed and operated in a way that will minimize or avoid the eventual long-term stewardship requirements. For example, machinery that processes radioactive materials was often built and operated inside a building that was not constructed to allow for the removal or decontamination of the machinery. These structural limitations have made decontamination difficult, or in some cases impossible, resulting in long-term stewardship requirements and the attendant long-term cost obligations. To ensure that long-term stewardship obligations are avoided to the extent possible, DOE will develop the necessary technical engineering and obtain the institutional authority to design and construct stewardship-compatible facilities. Developing these capabilities is particularly important because the ability of long-term stewardship to prevent human exposure or environmental damage remains uncertain. In cases where solutions to a problem remain elusive, prevention is the most prudent course of action.

Recently (December 2000), DOE established policy stating that the landlord organizations at sites with a continuing non-EM mission (e.g., DOE's Office of Defense Programs at the Nevada Test Site) will take responsibility for long-term stewardship after EM activities are completed (see Appendix I for more details).

These organizations are responsible for:

- working with cleanup program personnel to understand the technical scope and activities that will be required at the site to prevent unallowable releases and maintain acceptable levels of risk;
- identifying long-term science and technology needs such that those risks can ultimately be reduced;
- ensuring that all planned remediation activities are complete and that remediation goals have been met (or that the long-term remediation systems are constructed and operating as intended);
- verifying that documentation pertinent to cleanup and long-term stewardship is readily accessible;
- making sure that the site meets a set list of “acceptance criteria” ensuring environmental compliance commitments with regulators (e.g., have all unused monitoring wells been properly deactivated and closed?);
- coordinating with local, State, and Tribal governments regarding implementation of the long-term stewardship plans and future use of the sites;
- developing, implementing, and overseeing institutional controls; and
- maintaining long-term stewardship operating baselines so that accurate estimates of scope, schedule, and cost would be readily available for planning and budget purposes.

#### **4.2 PLANNING FOR LONG-TERM STEWARDSHIP**

As cleanup is completed and sites are “closed,” some Field staff are working to plan and document site cleanup activities such that the information needed for long-term stewardship will be available. In other cases this planning and documentation is not occurring. Limitations to more effective planning include the current lack of specific long-term stewardship guidance and the focus on accelerating cleanup activities rather than on long-term stewardship. This planning may be aided by development of guidance and policy that provide, for example, templates on the types of information that will be needed for long-term stewardship and to identify the components of a long-term stewardship plan. The long-term stewardship requirements at sites under the responsibility of the Grand Junction Office are clearly documented in site-specific Long-Term Stewardship Plans. At other sites, long-term stewardship activities may be included as part of site-wide management plans, unit-specific records of decision, or other remedial action documents.

From a national planning perspective, there is a clear need for such plans to be able to adequately detail the scope of activities anticipated in order to develop reliable costs and schedules. Long-term stewardship planning will also provide opportunities to identify issues or policies that could substantially improve the long-term stewardship program through risk and cost reduction.

From the local perspective, such planning efforts are critical to communicate the Department’s understanding of the hazards that remain at the sites, the importance of instituting and maintaining controls (either engineered or administrative controls), the specific activities that will be required to maintain protectiveness from the hazards that remain onsite, the potential impacts of failure, and a clear delineation of the roles and responsibilities for implementing these activities. In addition, detailed planning will allow site personnel to begin to recognize opportunities for cost savings (by understanding the overall scope of work ahead) through, for example, identification and disposition of excess property.

One means for capturing this information is to develop long-term stewardship plans that provide a consistent approach to documenting the required information. However, the information may also be presented in other documents, such as a specific section of the site-wide baselines and environmental compliance documents required by the Department’s environmental regulators (NRC, EPA, States).

The information in this Report is also the first step in helping the Department establish the ability to plan for natural hazards, such as floods and fires, that could exacerbate efforts to provide reliable long-term stewardship. Moreover, the Department may wish to examine the risk of long-term stewardship controls

failing, not only from natural hazards, but also from the failure of remedies, so that it can create a response capability and a contingency plan.

### **4.3 BUILDING LONG-TERM STEWARDSHIP ELEMENTS INTO LIFE-CYCLE PLANNING**

At sites where long-term stewardship is not anticipated for several years, the possibility exists for site personnel to evaluate all pending and future remediation decisions for opportunities to reduce the future long-term stewardship responsibilities or to make decisions that could eliminate the need for long-term stewardship altogether. This in no way means that decisions already made need to be revisited -- rather site personnel are encouraged to begin considering long-term stewardship costs and other implications (i.e., will there need to be an onsite presence to maintain long-term stewardship activities?) in their overall life-cycle planning efforts. While long-term stewardship will not always have an “end,” like most traditional projects, there is still a need to identify ways of reducing life-cycle costs and opportunities for reducing the Department’s long-term responsibilities.

These concepts also apply further up the “pipeline” as new facilities are proposed and constructed for new missions. Long-term stewardship needs to be considered in all aspects of new missions or projects to ensure that decisions are made to reduce or completely eliminate new long-term stewardship obligations. Consideration of long-term stewardship is important because it is not clear that long-term stewardship will work over the long periods of time it is likely to be required. Incorporating long-term stewardship prevention into project life-cycle planning is, therefore, an important activity.

### **4.4 SUMMARY**

This Report to Congress provides the first comprehensive projection of the Department’s long-term stewardship obligations, activities, and costs. As such, this Report marks a milestone toward building a reliable and cost-effective long-term stewardship program at the Department. The Department now has a stronger factual foundation from which to analyze long-term stewardship needs and activities. For example, information on projected long-term stewardship costs can help future decision-makers avoid creating unnecessary long-term liabilities, or inappropriately postpone actions with short-term cleanup decisions. A recent National Research Council report also noted the benefits of incorporating long-term stewardship costs into today’s decisions. These cost data can also help prevent excessive cleanup being conducted that will nonetheless require the same amount of long-term stewardship as a less expensive remedy, despite the additional cost and effort. In short, planning for long-term stewardship will help to improve near-term cleanup decisions and ensure that DOE fulfills its existing cleanup commitments.

Although this Report may be the Department’s first comprehensive report on long-term stewardship, it is far from the last word. The Department expects to: (1) continue conducting long-term stewardship activities at sites where they have already begun, and learning from that experience; (2) develop policies, related/other guidance, and staff training programs to ensure effective long-term stewardship planning and implementation; (3) develop long-term stewardship plans for sites that have not yet begun long-term stewardship activities; (4) ensure meaningful public participation; and (5) form better connections between agencies and staff involved in related activities at different sites and agencies to ensure effective integration across sites.

Much of the future long-term stewardship work may not be identified currently in the budget as “long-term stewardship.” The Department intends to seek to better integrate this work as part of its overall effort to accelerate completion of cleanup and to close sites in a way that allows them to be used for appropriate purposes.

## Appendices





## APPENDIX A: RELATIONSHIP TO OTHER INITIATIVES

The analysis in this Report is directly related to several other DOE initiatives that have shaped the evolution of the Environmental Management (EM) program. The 1995 and 1996 *Baseline Environmental Management Reports* provided the first comprehensive scope and cost estimates for the cleanup of the nuclear weapons complex. These reports clearly identified that most of the contaminated areas at DOE sites will not be remediated to “green fields” or unrestricted use and that almost all DOE sites would require long-term surveillance and monitoring far into the future.

The initial cost estimates developed in the *Baseline Environmental Management Reports* showed that the costs were \$230 billion and cleanup was scheduled to take 75 years. This effort was deemed by members of Congress as too expensive and requiring too long a timetable. One response to this realization was a DOE restructuring of how EM accounted for cleanup progress by focusing on discrete tasks that could be managed towards clear endpoints. This restructuring resulted in the *Accelerating Cleanup: Paths to Closure* reports, which identified strategies to reduce the schedule and costs associated with the previous estimates by accelerating site cleanup and closure and improving productivity. The 1998 and 2000 *Accelerating Cleanup: Paths to Closure* reports identified strategies to reduce the schedule and costs associated with the baseline reports by accelerating site cleanup and closure and improving productivity and integration in the Environmental Management program. The Department acknowledged the need for more comprehensive site end state and long-term stewardship plans.

In 1999, the Department released its first Report on long-term stewardship, entitled *From Cleanup to Stewardship: A Companion Report to Accelerating Cleanup: Paths to Closure and Background Information to Support the Scoping Process Required for the 1998 PEIS Settlement Study*, also referred to as the “Background Report.” The *Background Report* presented the first national summary of the nature and extent of DOE’s long-term stewardship needs and examined some of the issues, challenges, and barriers associated with the transition from cleanup to stewardship.

The analysis being conducted for this Report to Congress builds on the analysis presented in the *Background Report* by providing a more precise description of the overall site end states and the associated long-term stewardship costs and activities. Because the *Background Report* was based on data collected for purposes other than identifying long-term stewardship needs and responsibilities, many holes were left in the Department’s understanding of the specific stewardship responsibilities at many sites. This analysis attempts to refine that understanding and to develop a baseline estimate for the cost, scope, and schedule of long-term stewardship activities at each site.

### THE MAJOR FINDINGS OF THE BACKGROUND REPORT INCLUDE:

- Most of the sites in DOE’s cleanup program will require long-term stewardship;
- Long-term stewardship will be necessary wherever cleanup efforts do not achieve conditions that allow for unrestricted use;
- Cleanup to unrestricted use cannot always be achieved for several reasons, including technical and economic infeasibility;
- Long-term stewardship will involve a variety of activities, including both engineered and administrative controls;
- DOE is already performing long-term stewardship at a number of sites; and
- More research and analysis is needed to fully understand the nature of the challenge ahead.

A second, related long-term stewardship study is currently being conducted by DOE pursuant to a December 1998 lawsuit settlement agreement.<sup>45</sup> That resulting report, *The Draft Long-Term Stewardship Study*,

<sup>45</sup> Natural Resources Defense Council et al. v. Richardson et al., Civ. No.97-936 (SS) (D.D.C.), Dec. 12, 1998.

addresses national, programmatic, and cross-cutting issues related to long-term stewardship, such as options for financing, legal requirements, and program structure. The *Draft Long-Term Stewardship Study* addresses two specific goals:

- Analyze the national issues that DOE needs to address in planning for and conducting long-term stewardship activities.
- Promote information exchange on long-term stewardship issues among DOE, other Federal agencies, Tribal nations, State and local governments, and private citizens.

The issues addressed in *The Draft Long-Term Stewardship Study* were identified through a public scoping process that was consistent with the processes mandated in the National Environmental Policy Act (NEPA) regulations. Although the lawsuit settlement did not identify the issues that DOE should address, it did mandate that DOE follow the NEPA public scoping procedures. Unlike the analysis conducted for this Report, *The Draft Long-Term Stewardship Study* does not address site-specific issues or contain site- or portion-specific long-term stewardship data. *The Draft Long-Term Stewardship Study* is expected to be completed in late 2000.

**KEY CHALLENGES DISCUSSED IN THE  
DRAFT LONG-TERM STEWARDSHIP STUDY**

- Incorporating long-term stewardship considerations into cleanup decisions;
- Ensuring the continued effectiveness of long-term stewardship if property ownership changes;
- Ensuring open access to information about residual hazards;
- Ensuring reliable and sufficient funding;
- Maintaining continued partnerships with State, local, and Tribal governments;
- Developing mechanisms to promote the sustainability of long-term stewardship; and
- Building the concept of “stewardship prevention” into the planning processes for new missions and facilities.

**Relationship Between the Background Document, the *Draft Study*, and the *National Defense Authorization Act (NDAA) Report to Congress***

The Background Document (*From Cleanup to Stewardship*) provides background information for the long-term stewardship study scoping process required by the PEIS Settlement Agreement. The Background Document provides an overall summary of the nature and extent of current and anticipated long-term stewardship needs at all DOE sites. The Background Document also summarizes available information about the number and location of sites that will likely require long-term stewardship by DOE; the type of long-term stewardship activities likely to be required; and DOE sites at which long-term stewardship activities are currently being conducted. DOE used this information to identify sites where contaminated facilities, water, soil, and/or engineered units would likely remain after cleanup is complete and to estimate the scope of long-term stewardship activities needed.

DOE prepared the *Draft Study*, pursuant to the terms of the Settlement Agreement, to meet the commitment made in the Background Document and to respond to insights provided by the public during a recently completed public scoping process. The *Draft Study* does not analyze site-specific issues -- rather, it analyzes the national issues that DOE needs to address in planning for and conducting long-term stewardship activities. The *Draft Study* promotes exchange of long-term stewardship information between DOE and non-DOE agencies and organizations, including Tribal nations, State and local governments, and private citizens. The *Draft Study* will inform future DOE site and national programmatic decision makers affected by long-term stewardship issues.

This Report, the *National Defense Authorization Act (NDAA) Report to Congress*, will be the third important building block for developing DOE’s long-term stewardship program. While the *Draft Study* and Background

Document address long-term stewardship issues on a broad, complex-wide scale, this *Report to Congress* addresses DOE's long-term stewardship requirements on a more site-specific, detailed scale. As the title implies, this Report was requested in a Congressional report accompanying the National Defense Authorization Act for Fiscal Year 2000. This *Report to Congress*:

- Identifies sites or portions of sites where environmental restoration, waste disposal, and facility stabilization are projected to be complete by 2006 without unrestricted land use.
- Includes sufficient detail to undertake the necessary management and stewardship responsibilities, including cost, scope, and schedule.



APPENDIX B: LIST OF SITES INCLUDED IN VOLUME II OF THIS REPORT<sup>46</sup>

Table B-1. List of Sites and Portions of Sites by State

<i>State</i>	<i>Site</i>	<i>Portion</i>
Alaska	Amchitka Island <sup>a</sup>	Surface
		Subsurface
Arizona	Monument Valley Site <sup>a</sup>	Surface
		Subsurface
	Tuba City Site <sup>a</sup>	Surface
		Subsurface
California	Energy Technology Engineering Center	Unknown <sup>b</sup>
	General Atomics	Unknown <sup>b</sup>
	General Electric Vallecitos Nuclear Center	Unknown <sup>b</sup>
	Laboratory for Energy Related Health Research	Unknown <sup>b</sup>
	Lawrence Berkeley National Laboratory	Old Town
		Building 51/64 VOC Plume
		Building 71 Freon/VOC Plume
		Building 75 Tritium Plume
		Building 88 Area
	Lawrence Livermore National Laboratory - Livermore Site	Building 292 Area
		Building 331 Area
		Building 419/511
		Treatment Facility F/406
		Treatment Facility 5475
		Treatment Facility A
		Treatment Facility B
		Treatment Facility C
		Treatment Facility D
		Treatment Facility E
		Treatment Facility G
		Treatment Facility 518
	Lawrence Livermore National Laboratory - Site 300	OU #7 Building 832
		OU #8 Rest of Site
		OU #1 GSA
		OU #2 Building 834

<sup>46</sup> Includes 96 sites where DOE expects to perform long-term stewardship activities by 2006, and 33 sites where DOE will or may be responsible for long-term stewardship after 2006. Additionally, 11 sites where a non-DOE entity is responsible for long-term stewardship are listed, as well as the Ames Laboratory in Iowa. Therefore, the total number of sites listed and included in Volume II of this Report is 141.

**Table B-1. List of Sites and Portions of Sites by State**

<i>State</i>	<i>Site</i>	<i>Portion</i>
California	Lawrence Livermore National Laboratory - Site 300	OU #3 Pit 6
		OU #4 Building 815
		OU #5 Building 850 - Pits 3&5
		OU #6 Building 854
	Sandia National Laboratories - CA	Fuel Oil Spill
		Groundwater
		Navy Landfill
	Stanford Linear Accelerator	Site-wide Portion
Colorado	Bodo Canyon Cell	Site-wide Portion
	Burro Canyon Disposal Cell	Site-wide Portion
	Cheney Disposal Cell ( <i>Grand Junction Disposal Site</i> ) <sup>c</sup>	Site-wide Portion
	(Cotter) Cañon City Site	Unknown <sup>b</sup>
	Durango Mill <sup>a</sup>	Surface
		Subsurface
	Estes Gulch Disposal Cell	Site-wide Portion
	Fort St. Vrain	Site-wide Portion
	Grand Junction Mill 1	Site-wide Portion
	Grand Junction Mill 2	Site-wide Portion
	Gunnison Disposal Cell	Site-wide Portion
	Gunnison Mill <sup>a</sup>	Surface
		Subsurface
	(HECLA) Durita Site	Site-wide Portion
	Maybell Mill Site	Site-wide Portion
	Naturita Mill <sup>a</sup>	Surface
		Subsurface
	Naturita Site	Site-wide Portion
	Naval Oil Shale Reserves Site	Site-wide Portion
	Rifle (New) Mill <sup>a</sup>	Surface
		Subsurface
	Rifle (Old) Mill <sup>a</sup>	Surface
		Subsurface
	Rio Blanco <sup>a</sup>	Surface
		Subsurface
	Rocky Flats Environmental Technology Site	Site-wide Portion
	Rulison <sup>a</sup>	Surface
		Subsurface

**Table B-1. List of Sites and Portions of Sites by State**

<i>State</i>	<i>Site</i>	<i>Portion</i>
Colorado	Slick Rock (North Continent) Mill 1 <sup>a</sup>	Surface
		Subsurface
	Slick Rock (Union Carbide) Mill 2 <sup>a</sup>	Surface
		Subsurface
	(UMETCO) Maybell Site 2	Site-wide Portion
	(UMETCO) Uravan Site	Unknown <sup>b</sup>
Connecticut	CE	Unknown <sup>b</sup>
Florida	Pinellas STAR Center ( <i>Pinellas Plant</i> ) <sup>a,c</sup>	4.5 Acre Site
		Building 100
		Northeast Site
		Wastewater Neutralization Area/Building 200 Area
Idaho	Idaho National Engineering and Environmental Laboratory	ARA Soils
		Argonne West
		BORAX Area
		CFA
		EBR-1
		INTEC Sites
		Ordnance Area
		Other TAN Soils
		Pad A
		PBF Soils
		SL-1 Burial Ground
		TAN Building 616
		TAN Soils
		TAN Tanks
		TRA Ponds
		TRA Subsurface Soils
	Lowman Site	Site-wide Portion
Illinois	Argonne National Laboratory East	300 Area
		800 Area
		CP-5
		Rest of Site
	Fermi National Accelerator Laboratory	Site-wide Portion
	Madison	Unknown <sup>b</sup>
	Palos Forest (Site A/Plot M) Preserve ( <i>Site A/Plot M</i> ) <sup>c</sup>	Site-wide Portion
Iowa	Ames Laboratory	Clean Closure

**Table B-1. List of Sites and Portions of Sites by State**

<i>State</i>	<i>Site</i>	<i>Portion</i>
Kentucky	Maxey Flats Disposal Site	Unknown <sup>b</sup>
	Paducah Gaseous Diffusion Plant	Site-wide Portion
Maryland	W.R. Grace and Company	Unknown <sup>b</sup>
Massachusetts	Shpack Landfill	Unknown <sup>b</sup>
Mississippi	Salmon Site <sup>a</sup>	Surface
		Subsurface
Missouri	Kansas City Plant	Site-wide Portion
	Latty Avenue Properties	Unknown <sup>b</sup>
	St. Louis Airport Site	Unknown <sup>b</sup>
	St. Louis Airport Site Vicinity Properties	Unknown <sup>b</sup>
	St. Louis Downtown Site	Unknown <sup>b</sup>
	Weldon Spring Site	Chemical Plant
		Quarry Groundwater
	Westlake Disposal Site	Unknown <sup>b</sup>
Nebraska	Hallam Nuclear Power Facility	Site-wide Portion
Nevada	Central Nevada Test Area <sup>a</sup>	Surface
		Subsurface
	Nevada Test Site	Area 3 RWMS
		Area 5 RWMS
		Industrial Sites
		Soils
		UGTA
	Project Shoal <sup>a</sup>	Surface
		Subsurface
New Jersey	DuPont & Company	Unknown <sup>b</sup>
	Maywood Chemical Works	Unknown <sup>b</sup>
	Middlesex Sampling Plant	Unknown <sup>b</sup>
	Princeton Plasma Physics Laboratory	Site-wide Portion
	Wayne Site	Unknown <sup>b</sup>
New Mexico	Ambrosia Lake Site	Site-wide Portion
	Bayo Canyon	Site-wide Portion
	Bluewater Site ( <i>Arco Bluewater</i> ) <sup>c</sup>	Site-wide Portion
	Gasbuggy Site <sup>a</sup>	Surface
		Subsurface
	Gnome-Coach <sup>a</sup>	Surface
		Subsurface
	(Homestake) Grants Site	Unknown <sup>b</sup>



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<i>State</i>	<i>Site</i>	<i>Portion</i>
New Mexico	Los Alamos National Laboratory	Site-wide Portion
	Lovelace Respiratory Research Institute ( <i>Inhalation Toxicology Research Institute</i> ) <sup>c</sup>	Diesel Spill Site
		Hot Ponds
		Sewage Lagoon Site
	(Quivira) Ambrosia Lake Site 2	Unknown <sup>b</sup>
	Sandia National Laboratories - NM	CAM Unit
		Chemical Waste Landfill
		Groundwater
		MLLW Landfill
		Signed & Fenced Soil
		Signed Soils
	Shiprock Site <sup>a</sup>	Surface
		Subsurface
	(SOHIO) LBAR Site	Site-wide Portion
	South Valley Superfund Site	Unknown <sup>b</sup>
	(UNC) Church Rock Site	Unknown <sup>b</sup>
	Waste Isolation Pilot Plant	Unknown <sup>b</sup>
New York	Ashland Oil #1	Unknown <sup>b</sup>
	Ashland Oil #2	Unknown <sup>b</sup>
	Bliss and Laughlin Steel	Unknown <sup>b</sup>
	Brookhaven National Laboratory	BGRR/HFBR D&D
		Former HWMF
		Groundwater
		Landfills
		Other Radiated Soils
		Peconic River
		Rest of Site
	Colonie	Unknown <sup>b</sup>
	Linde Air Products	Unknown <sup>b</sup>
	Niagara Falls Storage Site	Unknown <sup>b</sup>
	Seaway Industrial Park	Unknown <sup>b</sup>
	West Valley Demonstration Project	Unknown <sup>b</sup>
Ohio	Ashtabula Environmental Management Project ( <i>RMI Titanium Company Site</i> ) <sup>c</sup>	Unknown <sup>b</sup>
	Battelle Columbus - King Avenue	Unknown <sup>b</sup>
	Battelle Columbus - West Jefferson	Unknown <sup>b</sup>
	Fernald Environmental Management Project	Site-wide Portion
	Luckey	Unknown <sup>b</sup>

Table B-1. List of Sites and Portions of Sites by State

<i>State</i>	<i>Site</i>	<i>Portion</i>
Ohio	Miamisburg Environmental Management Project ( <i>Mound</i> ) <sup>c</sup>	Site-wide Portion
	Painesville	Unknown <sup>b</sup>
	Piqua Nuclear Power Facility	Site-wide Portion
	Portsmouth Gaseous Diffusion Plant	Quadrant I
		Quadrant II
		Quadrant III
		Quadrant IV
Oregon	Lakeview Mill	Site-wide Portion
	Lakeview Site	Site-wide Portion
Pennsylvania	Burrell Site	Site-wide Portion
	Canonsburg Site	Site-wide Portion
Puerto Rico	Center for Energy and Environmental Research	Site-wide Portion
South Carolina	Savannah River Site	247-F Naval Fuel Manufacturing Facility
		D Area Heavy Water Facilities
		F Tank Area
		Four Mile Branch Watershed
		Heavy Water Component Test Reactor
		Lower Three Runs Watershed
		M Area Fuel/Target Manufacturing Facilities
		Pen Branch Watershed
		Savannah River & Floodplain Swamp Watershed
		Steel Creek Watershed
		Upper Three Runs Watershed
South Dakota	Edgemont Site	Site-wide Portion
Tennessee	Oak Ridge Reservation	Bear Creek Watershed
		Bethel Valley Watershed
		E. Tennessee Tech. Watershed
		Melton Valley Watershed
		Offsite
		Upper E. Fork Poplar Creek Watershed
Texas	(Chevron) Panna Maria Site	Site-wide Portion
	(Conoco) Conquista Site	Site-wide Portion
	(Exxon) Ray Point Site	Site-wide Portion
	Falls City Site	Site-wide Portion
	Pantex Plant	Risk Reduction Std 2
		Risk Reduction Std 3

**Table B-1. List of Sites and Portions of Sites by State**

<i>State</i>	<i>Site</i>	<i>Portion</i>
Utah	(Atlas) Moab Mill	Site-wide Portion
	(EFN) White Mesa Site	Unknown <sup>b</sup>
	Green River Site <sup>a</sup>	Surface
		Subsurface
	Mexican Hat Site	Site-wide Portion
	Monticello Mill Site and Vicinity Properties	Disposal Site
		Groundwater
		Supplemental Standards Areas
	(Plateau) Shootaring Canyon Site	Unknown <sup>b</sup>
	(Rio Algom) Lisbon Valley Site	Unknown <sup>b</sup>
	Salt Lake City Mill	Site-wide Portion
Washington	South Clive Disposal Cell	Site-wide Portion
	11e.(2) Disposal Site	Unknown <sup>b</sup>
	(Dawn) Ford Site	Unknown <sup>b</sup>
		100 B/C Area
		100 D Area
		100 F Area
		100 H Area
		100 K Area
		100 N Area
		100 Other Area
		1100 Area
		200 Area North
		200 Area PO1-1 GW
		300 Area
		Arid Land Ecology
		ERDF Cell
		Riverland
		Wahluke Slope
	(WNI) Sherwood Site	Site-wide Portion
West Virginia	Parkersburg Site ( <i>Amax</i> ) <sup>c</sup>	Site-wide Portion
Wyoming	(ANC) Gas Hills Site	Site-wide Portion
	(Exxon) Highlands Site	Site-wide Portion
	Hoe Creek Underground Coal Gasification Site	Site-wide Portion
	(Kennebecott) Sweetwater Site	Unknown <sup>b</sup>
	Naval Petroleum Reserve No. 3 Landfill/Landfarm	Site-wide Portion
	(Pathfinder) Lucky Mc Site	Site-wide Portion

**Table B-1. List of Sites and Portions of Sites by State**

<i>State</i>	<i>Site</i>	<i>Portion</i>
Wyoming	(Pathfinder) Shirley Basin Site 2	Site-wide Portion
	(Petrotomics) Shirley Basin Site 1	Site-wide Portion
	Riverton Site	Site-wide Portion
	Rock Springs Oil Shale Retort Site	Site-wide Portion
	Spook Site	Site-wide Portion
	(UMETCO) Gas Hills Site	Site-wide Portion
	(Union Pacific) Bear Creek Site	Site-wide Portion
	(WNI) Split Rock Site	Site-wide Portion

<sup>a</sup> For remediation of sites, DOE distinguishes the surface from the subsurface activity. The long-term stewardship start date reflects the completion of surface remediation. However, characterization of the subsurface contamination will continue well beyond 2006.

<sup>b</sup> For these sites, it has yet to be determined what portion, if any, will require long-term stewardship activities by DOE.

<sup>c</sup> In some cases, sites are known by alternate names which are italicized in parentheses.

**Table B-2. List of Sites and Portions of Sites by DOE Office**

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Albuquerque	Kansas City Plant	Site-wide Portion
	Los Alamos National Laboratory	Site-wide Portion
	Lovelace Respiratory Research Institute ( <i>Inhalation Toxicology Research Institute</i> ) <sup>c</sup>	Diesel Spill Site
		Hot Ponds
		Sewage Lagoon Site
	Pantex Plant	Risk Reduction Std 2
		Risk Reduction Std 3
	Sandia National Laboratories - CA	Fuel Oil Spill
		Groundwater
		Navy Landfill
	Sandia National Laboratories - NM	CAM Unit
		Chemical Waste Landfill
		Groundwater
		MLLW Landfill
		Signed & Fenced Soil
		Signed Soils
	South Valley Superfund Site	Unknown <sup>b</sup>
Carlsbad	Waste Isolation Pilot Plant	Unknown <sup>b</sup>
Chicago	Ames Laboratory	Clean Closure
	Argonne National Laboratory East	300 Area
		800 Area
		CP-5
		Rest of Site
	Brookhaven National Laboratory	BGRR/HFBR D&D
		Former HWMF
		Groundwater
		Landfills
		Other Rad Soils
		Peconic River
		Rest of Site
	Fermi National Accelerator Laboratory	Site-wide Portion
	Princeton Plasma Physics Laboratory	Site-wide Portion
Fossil Energy	Hoe Creek Underground Coal Gasification Site	Site-wide Portion
	Naval Oil Shale Reserves Site	Site-wide Portion
	Naval Petroleum Reserve No. 3 Landfill/Landfarm	Site-wide Portion
	Rock Springs Oil Shale Retort Site	Site-wide Portion
Grand Junction	Ambrosia Lake Site	Site-wide Portion
	(ANC) Gas Hills Site	Site-wide Portion

**Table B-2. List of Sites and Portions of Sites by DOE Office**

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Grand Junction	(Atlas) Moab Mill	Site-wide Portion
	Bluewater Site ( <i>Arco Bluewater</i> ) <sup>c</sup>	Site-wide Portion
	Bodo Canyon Cell	Site-wide Portion
	Burrell Site	Site-wide Portion
	Burro Canyon Disposal Cell	Site-wide Portion
	Canonsburg Site	Site-wide Portion
	Cheney Disposal Cell ( <i>Grand Junction Disposal Site</i> ) <sup>c</sup>	Site-wide Portion
	(Chevron) Panna Maria Site	Site-wide Portion
	(Conoco) Conquista Site	Site-wide Portion
	(Cotter) Cañon City Site	Unknown <sup>b</sup>
	(Dawn) Ford Site	Unknown <sup>b</sup>
	Durango Mill <sup>a</sup>	Surface
		Subsurface
	Edgemont Site	Site-wide Portion
	(EFN) White Mesa Site	Unknown <sup>b</sup>
	Estes Gulch Disposal Cell	Site-wide Portion
	(Exxon) Highlands Site	Site-wide Portion
	(Exxon) Ray Point Site	Site-wide Portion
	Falls City Site	Site-wide Portion
	Grand Junction Mill 1	Site-wide Portion
	Grand Junction Mill 2	Site-wide Portion
	Green River Site <sup>a</sup>	Surface
		Subsurface
	Gunnison Disposal Cell	Site-wide Portion
	Gunnison Mill <sup>a</sup>	Surface
		Subsurface
	Hallam Nuclear Power Facility	Site-wide Portion
	(HECLA) Durita Site	Site-wide Portion
	(Homestake) Grants Site	Unknown <sup>b</sup>
	(Kennebecott) Sweetwater Site	Unknown <sup>b</sup>
	Lakeview Mill	Site-wide Portion
	Lakeview Site	Site-wide Portion
	Lowman Site	Site-wide Portion
	Maybell Mill Site	Site-wide Portion
	Mexican Hat Site	Site-wide Portion
	Monticello Mill Site and Vicinity Properties	Disposal Site
		Groundwater
		Supplemental Standards Areas

**Table B-2. List of Sites and Portions of Sites by DOE Office**

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Grand Junction	Monument Valley Site <sup>a</sup>	Surface
		Subsurface
	Naturita Mill <sup>a</sup>	Surface
		Subsurface
	Naturita Site	Site-wide Portion
	Palos Forest (Site A/Plot M) Preserve ( <i>Site A/Plot M</i> ) <sup>c</sup>	Site-wide Portion
	Parkersburg Site ( <i>Amax</i> ) <sup>c</sup>	Site-wide Portion
	(Pathfinder) Lucky Mc Site	Site-wide Portion
	(Pathfinder) Shirley Basin Site 2	Site-wide Portion
	(Petrochemicals) Shirley Basin Site 1	Site-wide Portion
	Pinellas STAR Center ( <i>Pinellas Plant</i> ) <sup>a,c</sup>	4.5 Acre Site
		Building 100
		Northeast Site
		Wastewater Neutralization Area/Building 200 Area
	Piqua Nuclear Power Facility	Site-wide Portion
	(Plateau) Shooting Canyon Site	Unknown <sup>b</sup>
	(Quivira) Ambrosia Lake Site 2	Unknown <sup>b</sup>
	Rifle (New) Mill <sup>a</sup>	Surface
		Subsurface
	Rifle (Old) Mill <sup>a</sup>	Surface
		Subsurface
	(Rio Algom) Lisbon Valley Site	Unknown <sup>b</sup>
	Riverton Site	Site-wide Portion
	Salt Lake City Mill	Site-wide Portion
	Shiprock Site <sup>a</sup>	Surface
		Subsurface
	Slick Rock (North Continent) Mill 1 <sup>a</sup>	Surface
		Subsurface
	Slick Rock (Union Carbide) Mill 2 <sup>a</sup>	Surface
		Subsurface
	(SOHIO) LBAR Site	Site-wide Portion
	South Clive Disposal Cell	Site-wide Portion
	Spook Site	Site-wide Portion
	Tuba City Site <sup>a</sup>	Surface
		Subsurface
	(UMETCO) Gas Hills Site	Site-wide Portion
	(UMETCO) Maybell Site 2	Site-wide Portion

**Table B-2. List of Sites and Portions of Sites by DOE Office**

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Grand Junction	(UMETCO) Uravan Site	Unknown <sup>b</sup> Portion
	(UNC) Church Rock Site	Unknown <sup>b</sup> Portion
	(Union Pacific) Bear Creek Site	Site-wide Portion
	Weldon Spring Site	Chemical Plant
		Quarry Groundwater
	(WNI) Sherwood Site	Site-wide Portion
	(WNI) Split Rock Site	Site-wide Portion
	11e.(2) Disposal Site <sup>d</sup>	Unknown <sup>b</sup>
Idaho	Fort St. Vrain	Site-wide Portion
	Idaho National Engineering and Environmental Laboratory	ARA Soils
		Argonne West
		BORAX Area
		CFA
		EBR-1
		INTEC Sites
		Ordnance Area
		Other TAN Soils
		Pad A
		PBF Soils
		SL-1 Burial Ground
		TAN Building 616
		TAN Soils
		TAN Tanks
		TRA Ponds
		TRA Subsurface Soils
Nevada	Amchitka Island <sup>a</sup>	Surface
		Subsurface
	Central Nevada Test Area <sup>a</sup>	Surface
		Subsurface
	Gasbuggy Site <sup>a</sup>	Surface
		Subsurface
	Gnome-Coach <sup>a</sup>	Surface
		Subsurface
	Nevada Test Site	Area 3 RWMS
		Area 5 RWMS
		Industrial Sites
		Soils
		UGTA



**Table B-2. List of Sites and Portions of Sites by DOE Office**

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Nevada	Project Shoal <sup>a</sup>	Surface
		Subsurface
	Rio Blanco <sup>a</sup>	Surface
		Subsurface
	Rulison <sup>a</sup>	Surface
		Subsurface
	Salmon Site <sup>a</sup>	Surface
		Subsurface
Oakland	Energy Technology Engineering Center	Unknown <sup>b</sup>
	General Atomics	Unknown <sup>b</sup>
	General Electric Vallecitos Nuclear Center	Unknown <sup>b</sup>
	Laboratory for Energy Related Health Research	Unknown <sup>b</sup>
	Lawrence Berkeley National Laboratory	Old Town
		Building 51/64VOC Plume
		Building 71 Freon/VOC Plume
		Building 75 Tritium Plume
		Building 88 Area
	Lawrence Livermore National Laboratory - Livermore Site	Building 292 Area
		Building 331 Area
		Building 419/511
		Treatment Facility F/406
		Treatment Facility 5475
		Treatment Facility A
		Treatment Facility B
		Treatment Facility C
		Treatment Facility D
		Treatment Facility E
		Treatment Facility G
		Treatment Facility 518
	Lawrence Livermore National Laboratory - Site 300	OU #7 Building 832
		OU #8 Site
		OU #1 GSA
		OU #2 Building 834
		OU #3 Pit 6
		OU #4 Building 815
		OU #5 Building 850 - Pits 3 & 5
		OU #6 Building 854
	Stanford Linear Accelerator	Site-wide Portion

Table B-2. List of Sites and Portions of Sites by DOE Office

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Oak Ridge	Bayo Canyon	Site-wide Portion
	Center for Energy and Environmental Research	Site-wide Portion
	Maxey Flats Disposal Site	Unknown <sup>b</sup>
	Oak Ridge Reservation	Bear Creek Watershed
		Bethel Valley Watershed
		E. Tenn. Tech. Watershed
		Melton Valley Watershed
		Offsite
		Upper E. Fork Poplar Creek Watershed
	Paducah Gaseous Diffusion Plant	Site-wide Portion
	Portsmouth Gaseous Diffusion Plant	Quadrant I
		Quadrant II
		Quadrant III
		Quadrant IV
	Westlake Disposal Site	Unknown <sup>b</sup>
Ohio	Ashtabula Environmental Management Project ( <i>RMI Titanium Company Site</i> ) <sup>c</sup>	Unknown <sup>b</sup>
	Battelle Columbus - King Avenue	Unknown <sup>b</sup>
	Battelle Columbus - West Jefferson	Unknown <sup>b</sup>
	Fernald Environmental Management Project	Site-wide Portion
	Miamisburg Environmental Management Project ( <i>Mound</i> ) <sup>c</sup>	Site-wide Portion
	West Valley Demonstration Project, New York	Unknown <sup>b</sup>
Rocky Flats	Rocky Flats Environmental Technology Site	Site-wide Portion
Richland	Hanford Site	100 B/C Area
		100 D Area
		100 F Area
		100 H Area
		100 K Area
		100 N Area
		100 Other Area
		1100 Area
		200 Area North
		200 Area PO1-1 GW
		300 Area
		Arid Land Ecology
		ERDF Cell
		Riverland
		Wahluke Slope

**Table B-2. List of Sites and Portions of Sites by DOE Office**

<i>DOE Office</i>	<i>Site</i>	<i>Portion</i>
Savannah River	Savannah River Site	247-F Naval Fuel Manufacturing Facility
		D Area Heavy Water Facilities
		F Tank Area
		Four Mile Branch Watershed
		Heavy Water Component Test Reactor
		Lower Three Runs Watershed
		M Area Fuel/Target Manufacturing Facilities
		Pen Branch Watershed
		Steel Creek Watershed
		Savannah River & Floodplain Swamp Watershed
		Upper Three Runs Watershed
FUSRAP Sites <sup>c</sup>	Ashland Oil #1	Unknown <sup>b</sup>
	Ashland Oil #2	Unknown <sup>b</sup>
	Bliss and Laughlin Steel	Unknown <sup>b</sup>
	CE	Unknown <sup>b</sup>
	Colonie	Unknown <sup>b</sup>
	DuPont & Company	Unknown <sup>b</sup>
	Latty Avenue Properties	Unknown <sup>b</sup>
	Linde Air Products	Unknown <sup>b</sup>
	Luckey	Unknown <sup>b</sup>
	Madison	Unknown <sup>b</sup>
	Maywood Chemical Works	Unknown <sup>b</sup>
	Middlesex Sampling Plant	Unknown <sup>b</sup>
	Niagara Falls Storage Site	Unknown <sup>b</sup>
	Painesville	Unknown <sup>b</sup>
	St. Louis Airport Site	Unknown <sup>b</sup>
	St. Louis Airport Site Vicinity Properties	Unknown <sup>b</sup>
	St. Louis Downtown Site	Unknown <sup>b</sup>
	Seaway Industrial Park	Unknown <sup>b</sup>
	Shpack Landfill	Unknown <sup>b</sup>
	W.R. Grace and Company	Unknown <sup>b</sup>
	Wayne Site	Unknown <sup>b</sup>

<sup>a</sup> For the remediation of the sites, the Department distinguishes the surface from the subsurface activity. The long-term stewardship start date reflects the completion of surface remediation. However, characterization of the subsurface contamination will continue well beyond 2006.

<sup>b</sup> For these sites, it has yet to be determined what portion, if any, will require long-term stewardship activities by DOE.

<sup>c</sup> In some cases, sites are known by alternate names which are italicized in parentheses.

<sup>d</sup> The operations office has yet to be determined, but will most likely be the Grand Junction Office.

<sup>e</sup> Cleanup responsibility for these 21 FUSRAP sites has been assigned to the U.S. Army Corps of Engineers (Corps). The Department and the Corps signed a Memorandum of Understanding (MOU) in March 1999 which assigns responsibility to DOE for any required long-term stewardship activities. However, the cleanup decisions for these sites are not yet final and, therefore, the level of long-term stewardship required for these sites, if any, is not yet known.

Table B-3. List of Sites and Portions of Sites by Site Name

<i>Site</i>	<i>Portion</i>
Ambrosia Lake Site	Site-wide Portion
Amchitka Island <sup>a</sup>	Surface
	Subsurface
Ames Laboratory	Clean Closure
(ANC) Gas Hills Site	Site-wide Portion
Argonne National Laboratory East	300 Area
	800 Area
	CP-5
	Rest of Site
Ashland Oil #1	Unknown <sup>b</sup>
Ashland Oil #2	Unknown <sup>b</sup>
Ashtabula Environmental Management Project (RMI Titanium Company Site) <sup>c</sup>	Unknown <sup>b</sup>
(Atlas) Moab Mill	Site-wide Portion
Battelle Columbus - King Avenue	Unknown <sup>b</sup>
Battelle Columbus - West Jefferson	Unknown <sup>b</sup>
Bayo Canyon	Site-wide Portion
Bliss and Laughlin Steel	Unknown <sup>b</sup>
Bluewater Site ( <i>Arco Bluewater</i> ) <sup>c</sup>	Site-wide Portion
Bodo Canyon Cell	Site-wide Portion
Brookhaven National Laboratory	BGRR/HFBR D&D
	Former HWMF
	Groundwater
	Landfills
	Other Radiated Soils
	Peconic River
	Rest of Site
Burrell Site	Site-wide Portion
Burro Canyon Disposal Cell	Site-wide Portion
Canonsburg Site	Site-wide Portion
CE	Unknown <sup>b</sup>
Center for Energy and Environmental Research	Site-wide Portion
Central Nevada Test Area <sup>a</sup>	Surface
	Subsurface
Cheney Disposal Cell ( <i>Grand Junction Disposal Site</i> ) <sup>c</sup>	Site-wide Portion
(Chevron) Panna Maria Site	Site-wide Portion
Colonie	Unknown <sup>b</sup>
(Conoco) Conquista Site	Site-wide Portion

Table B-3. List of Sites and Portions of Sites by Site Name

<i>Site</i>	<i>Portion</i>
(Cotter) Cañon City Site	Unknown <sup>b</sup>
(Dawn) Ford Site	Unknown <sup>b</sup>
DuPont & Company	Unknown <sup>b</sup>
Durango Mill <sup>a</sup>	Surface
	Subsurface
Edgemont Site	Site-wide Portion
(EFN) White Mesa Site	Unknown <sup>b</sup>
Energy Technology Engineering Center	Unknown <sup>b</sup>
Estes Gulch Disposal Cell	Site-wide Portion
(Exxon) Highlands Site	Site-wide Portion
(Exxon) Ray Point Site	Site-wide Portion
Falls City Site	Site-wide Portion
Fermi National Accelerator Laboratory	Site-wide Portion
Fernald Environmental Management Project	Site-wide Portion
Fort St. Vrain	Site-wide Portion
Gasbuggy Site <sup>a</sup>	Surface
	Subsurface
General Atomics	Unknown <sup>b</sup>
General Electric Vallecitos Nuclear Center	Unknown <sup>b</sup>
Gnome-Coach <sup>a</sup>	Surface
	Subsurface
Grand Junction Mill 1	Site-wide Portion
Grand Junction Mill 2	Site-wide Portion
Green River Site <sup>a</sup>	Surface
	Subsurface
Gunnison Disposal Cell	Site-wide Portion
Gunnison Mill <sup>a</sup>	Surface
	Subsurface
Hallam Nuclear Power Facility	Site-wide Portion
Hanford Site	100 B/C Area
	100 D Area
	100 F Area
	100 H Area
	100 K Area
	100 N Area
	100 Other Area
	1100 Area

**Table B-3. List of Sites and Portions of Sites by Site Name**

<i>Site</i>	<i>Portion</i>
	200 Area North
	200 Area PO1-1 GW
	300 Area
	Arid Land Ecology
	ERDF Cell
	Riverland
	Wahluke Slope
(HECLA) Durita Site	Site-wide Portion
Hoe Creek Underground Coal Gasification Site	Site-wide Portion
(Homestake) Grants Site	Unknown <sup>b</sup>
Idaho National Engineering and Environmental Laboratory	ARA Soils
	Argonne West
	BORAX Area
	CFA
	EBR-1
	INTEC Sites
	Ordnance Area
	Other TAN Soils
	Pad A
	PBF Soils
	SL-1 Burial Ground
	TAN Building 616
	TAN Soils
	TAN Tanks
	TRA Ponds
	TRA Subsurface Soils
Kansas City Plant	Site-wide Portion
(Kennebecott) Sweetwater Site	Unknown <sup>b</sup>
Laboratory for Energy Related Health Research	Unknown <sup>b</sup>
Lakeview Mill	Site-wide Portion
Lakeview Site	Site-wide Portion
Latty Avenue Properties	Unknown <sup>b</sup>
Lawrence Berkeley National Laboratory	Old Town
	Building 51/64 VOC Plume
	Building 71 Freon/VOC Plume
	Building 75 Tritium Plume
	Building 88 Area

Table B-3. List of Sites and Portions of Sites by Site Name

<i>Site</i>	<i>Portion</i>
Lawrence Livermore National Laboratory - Livermore Site	Building 292 Area
	Building 331 Area
	Building 419/511
	Treatment Facility F/406
	Treatment Facility 5475
	Treatment Facility A
	Treatment Facility B
	Treatment Facility C
	Treatment Facility D
	Treatment Facility E
	Treatment Facility G
	Treatment Facility 518
Lawrence Livermore National Laboratory - Site 300	OU #7 Building 832
	OU #8 Rest of Site
	OU #1 GSA
	OU #2 Building 834
	OU #3 Pit 6
	OU #4 Building 815
	OU #5 Building 850 - Pits 3&5
	OU #6 Building 854
Linde Air Products	Unknown <sup>b</sup>
Los Alamos National Laboratory	Site-wide Portion
Lovelace Respiratory Research Institute ( <i>Inhalation Toxicology Research Institute</i> ) <sup>c</sup>	Diesel Spill Site
	Hot Ponds
	Sewage Lagoon Site
Lowman Site	Site-wide Portion
Luckey	Unknown <sup>b</sup>
Madison	Unknown <sup>b</sup>
Maxey Flats Disposal Site	Unknown <sup>b</sup>
Maybell Mill Site	Site-wide Portion
Maywood Chemical Works	Unknown <sup>b</sup>
Mexican Hat Site	Site-wide Portion
Miamisburg Environmental Management Project ( <i>Mound</i> ) <sup>c</sup>	Site-wide Portion
Middlesex Sampling Plant	Unknown <sup>b</sup>
Monticello Mill Site and Vicinity Properties	Disposal Site
	Groundwater
	Supplemental Standards Areas



Table B-3. List of Sites and Portions of Sites by Site Name

<i>Site</i>	<i>Portion</i>
Monument Valley Site <sup>a</sup>	Surface
	Subsurface
Naturita Mill <sup>a</sup>	Surface
	Subsurface
Naturita Site	Site-wide Portion
Naval Oil Shale Reserves Site	Site-wide Portion
Naval Petroleum Reserve No. 3 Landfill/Landfarm	Site-wide Portion
Nevada Test Site	Area 3 RWMS
	Area 5 RWMS
	Industrial Sites
	Soils
	UGTA
Niagara Falls Storage Site	Unknown <sup>b</sup>
Oak Ridge Reservation	Bear Creek Watershed
	Bethel Valley Watershed
	E. Tennessee Tech. Watershed
	Melton Valley Watershed
	Offsite
	Upper E. Fork Poplar Creek Watershed
Paducah Gaseous Diffusion Plant	Site-wide Portion
Painesville	Unknown <sup>b</sup>
Palos Forest (Site A/Plot M) Preserve ( <i>Site A/Plot M</i> ) <sup>c</sup>	Site-wide Portion
Pantex Plant	Risk Reduction Std 2
	Risk Reduction Std 3
Parkersburg Site ( <i>Amax</i> ) <sup>c</sup>	Site-wide Portion
(Pathfinder) Lucky Mc Site	Site-wide Portion
(Pathfinder) Shirley Basin Site 2	Site-wide Portion
(Petrotoomics) Shirley Basin Site 1	Site-wide Portion
Pinellas STAR Center ( <i>Pinellas Plant</i> ) <sup>a,c</sup>	4.5 Acre Site
	Building 100
	Northeast Site
	Wastewater Neutralization Area/Building 200 Area
Piqua Nuclear Power Facility	Site-wide Portion
(Plateau) Shooting Canyon Site	Unknown <sup>b</sup>
Portsmouth Gaseous Diffusion Plant	Quadrant I
	Quadrant II
	Quadrant III

**Table B-3. List of Sites and Portions of Sites by Site Name**

<i>Site</i>	<i>Portion</i>
	Quadrant IV
Princeton Plasma Physics Laboratory	Site-wide Portion
Project Shoal <sup>a</sup>	Surface
	Subsurface
(Quivira) Ambrosia Lake Site 2	Unknown <sup>b</sup>
Rifle (New) Mill <sup>a</sup>	Surface
	Subsurface
Rifle (Old) Mill <sup>a</sup>	Surface
	Subsurface
(Rio Algom) Lisbon Valley Site	Unknown <sup>b</sup>
Rio Blanco <sup>a</sup>	Surface
	Subsurface
Riverton Site	Site-wide Portion
Rock Springs Oil Shale Retort Site	Site-wide Portion
Rocky Flats Environmental Technology Site	Site-wide Portion
Rulison <sup>a</sup>	Surface
	Subsurface
St. Louis Airport Site	Unknown <sup>b</sup>
St. Louis Airport Site Vicinity Properties	Unknown <sup>b</sup>
St. Louis Downtown Site	Unknown <sup>b</sup>
Salmon Site <sup>a</sup>	Surface
	Subsurface
Salt Lake City Mill	Site-wide Portion
Sandia National Laboratories - CA	Fuel Oil Spill
	Groundwater
	Navy Landfill
Sandia National Laboratories - NM	CAM Unit
	Chemical Waste Landfill
	Groundwater
	MLLW Landfill
	Signed & Fenced Soil
	Signed Soils
Savannah River Site	247-F Naval Fuel Manufacturing Facility
	D Area Heavy Water Facilities
	F Tank Area
	Four Mile Branch Watershed
	Heavy Water Component Test Reactor

Table B-3. List of Sites and Portions of Sites by Site Name

<i>Site</i>	<i>Portion</i>
	Lower Three Runs Watershed
	M Area Fuel/Target Manufacturing Facilities
	Pen Branch Watershed
	Savannah River & Floodplain Swamp Watershed
	Steel Creek Watershed
	Upper Three Runs Watershed
Seaway Industrial Park	Unknown <sup>b</sup>
Shiprock Site <sup>a</sup>	Surface
	Subsurface
Shpack Landfill	Unknown <sup>b</sup>
Slick Rock (North Continent) Mill 1 <sup>a</sup>	Surface
	Subsurface
Slick Rock (Union Carbide) Mill 2 <sup>a</sup>	Surface
	Subsurface
(SOHIO) LBAR Site	Site-wide Portion
South Clive Disposal Cell	Site-wide Portion
South Valley Superfund Site	Unknown <sup>b</sup>
Spook Site	Site-wide Portion
Stanford Linear Accelerator	Site-wide Portion
Tuba City Site <sup>a</sup>	Surface
	Subsurface
(UMETCO) Gas Hills Site	Site-wide Portion
(UMETCO) Maybell Site 2	Site-wide Portion
(UMETCO) Uravan Site	Unknown <sup>b</sup>
(UNC) Church Rock Site	Unknown <sup>b</sup>
(Union Pacific) Bear Creek Site	Site-wide Portion
W.R. Grace and Company	Unknown <sup>b</sup>
Waste Isolation Pilot Plant	Unknown <sup>b</sup>
Wayne Site	Unknown <sup>b</sup>
Weldon Spring Site	Chemical Plant
	Quarry Groundwater
West Valley Demonstration Project	Unknown <sup>b</sup>
Westlake Disposal Site	Unknown <sup>b</sup>
(WNI) Sherwood Site	Site-wide Portion
(WNI) Split Rock Site	Site-wide Portion
11e.(2) Disposal Site <sup>d</sup>	Unknown <sup>b</sup>

<sup>a</sup> For the remediation of the sites, the Department distinguishes the surface from the subsurface activity. The long-term stewardship start date reflects the completion of surface remediation. However, characterization of the subsurface contamination will continue

well beyond 2006.

<sup>b</sup> For these sites, it has yet to be determined what portion, if any, will require long-term stewardship activities by DOE.

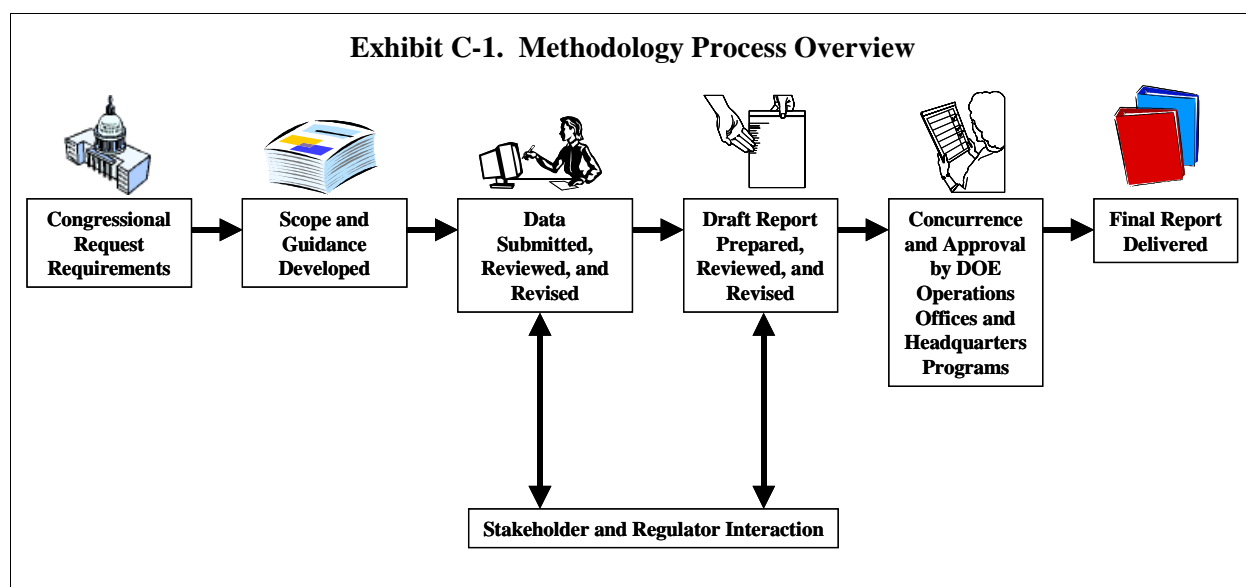
<sup>c</sup> In some cases, sites are known by alternate names which are italicized in parentheses.

<sup>d</sup> The operations office has yet to be determined, but will most likely be the Grand Junction Office.

## APPENDIX C: METHODOLOGY

### 1.0 PROCESS FOR DEVELOPING THE REPORT

This report is developed by compiling information from the DOE Field offices in response to a data call designed to meet the Congressional request. Each step in this methodology is described below and illustrated in Exhibit C-1.



### 1.1 CONGRESSIONAL REQUEST REQUIREMENTS

The report accompanying the FY 2000 *National Defense Authorization Act* requested that the Department provide Congress with:

*A report on existing and anticipated long-term environmental stewardship responsibilities for those Department of Energy sites or portions of sites for which environmental restoration, waste disposal, and facility stabilization is expected to be completed by the end of calendar year 2006. The report shall include a description of what sites, whole and geographically distinct locations, as well as specific disposal cells, contained contamination areas, and entombed contaminated facilities that cannot or are not anticipated to be cleaned up to standards allowing for unrestricted use. The report shall also identify the long-term stewardship responsibilities (for example, longer than 30 years) that would be required at each site, including soil and groundwater monitoring, record-keeping, and containment structure maintenance. In those cases where the Department has a reasonably reliable estimate of annual or long-term costs for stewardship activities, such costs shall be provided.<sup>47</sup>*

<sup>47</sup> Fiscal Year 2000 *National Defense Authorization Act* Conference Report, Congressional Record, August 5, 1999 (page H7855).

## 1.2 DEVELOPING THE SCOPE AND GUIDANCE OF THE REPORT

In response to this request, DOE Headquarters and Field personnel worked closely to accomplish three tasks:

- Identify the potential list of sites and portions of sites within the scope of the analysis (Section 1.2.1);
- Obtain the necessary information needed to fulfill the NDAA requirements (Section 1.2.2); and
- Develop this Report, including the site summaries presented in Volume II (Section 1.4).

The scope of this Report was developed to respond to the preceding report language, as well as other drivers, as indicated below:

- Congress is increasingly aware that DOE's responsibilities will not be eliminated when "cleanup" is complete and is interested in understanding the estimated size of the remaining responsibilities.
- In order to support a credible long-term stewardship program, Congress has expressed a strong interest in learning as much as possible about "portions of sites" where cleanup and stabilization are currently complete or will be complete.
- During the past 10 years, Congress has appropriated substantial funding (nearly \$60 billion) for DOE to conduct environmental management activities, and DOE needs to demonstrate the degree of success achieved by that funding.

Generally, the scope of this Report includes those sites where cleanup is currently managed by DOE, where DOE has a clear and planned responsibility for long-term stewardship after cleanup, and where the level of cleanup will result in residual contamination at levels greater than what is acceptable for unrestricted use. In accordance with the NDAA language, this includes all sites or portions of sites where long-term stewardship activities are anticipated by the end of calendar year 2006. This Report also identifies, to a lesser extent, those sites where long-term stewardship activities are anticipated, but where the long-term stewardship activities will not begin until after 2006. The scope reflects current policies, understandings, and information available at the time of development of this Report.

### 1.2.1 Identifying Sites within the Scope of the Report

The first task was to identify the list of sites within the scope of this Report. To accomplish this task, DOE staff identified those sites where cleanup is currently managed by DOE, where DOE has a clear and planned responsibility for long-term stewardship after cleanup, and where the level of cleanup will result in residual contamination at levels greater than what is acceptable for unrestricted use. The initial list of sites came from DOE's 1999 *Background Report* on long-term stewardship, which identified 144 sites where DOE could potentially have long-term stewardship responsibilities.<sup>48</sup>

#### DOE SITES ARE NOT ALL ALIKE

DOE sites vary significantly from one another not only in size, but also in terms of past missions and the resulting nature of residual contamination. For example, the Hanford Site covers 375,000 acres and had past missions including fuel and target fabrication, production reactor operations, chemical separations, and component fabrications. The Piqua Nuclear Power Facility is a small site (0.5 acre), which formerly contained a single thermal, organically-cooled and moderated, demonstration reactor.

DOE's project team then refined this list to determine the scope of sites to be covered by this Report, as described in the paragraphs below (see Exhibit C-2).

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<sup>48</sup> *From Cleanup to Stewardship: A Companion Report to Accelerating Cleanup: Paths to Closure and Background Information to Support the Scoping Process Required for the 1998 PEIS Settlement Study*, U.S. Department of Energy, DOE/EM-0466, October 1999.

First, after discussions with site personnel, the project team combined the Argonne National Laboratory-West (ANL-W) site with the Idaho National Engineering and Environmental Laboratory, and combined the Oak Ridge Associated Universities (ORAU) with the Oak Ridge Reservation, thereby further reducing the number of sites by two (both ANL-W and ORAU are located within the boundaries of the larger site with which each was combined). The next step was to identify the sites where DOE expects to clean up to levels allowing for unrestricted use and, therefore, these sites are excluded from the scope of this Report. The list of these sites is included in Exhibit C-2. This consolidation and elimination reduced the number of sites identified in the *Background Report* by 36 to 108 sites.

Second, several sites were added to the report, including the Fort St. Vrain site, a privately-owned former nuclear reactor and current spent nuclear fuel storage installation. This site was included in the list of sites because DOE is responsible for monitoring the spent nuclear fuel stored at this site. The Westlake site, a privately-owned landfill, was included in this Report because DOE will be responsible for a percentage of site remediation costs as a liable third-party. An additional disposal site, 11e.(2) Disposal Site in Utah, was added. DOE anticipates future responsibility for this site because of disposal of 112.(2) wastes by DOE.

Third, because the scope of this analysis encompasses all DOE sites with potential long-term stewardship responsibilities, rather than just those managed by the Environmental Management (EM) program, DOE identified sites outside the scope of the EM program that fit the criteria established in the Congressional mandate. DOE identified four sites -- Naval Oil Shale Reserves Site, Naval Petroleum Reserve No. 3 Landfill/Landfarm, Rock Springs Oil Shale Retort Site, and the Hoe Creek Underground Coal Gasification Site -- managed by the Office of Fossil Energy where all planned remediation activities will be complete by the end of 2006, after which long-term stewardship activities are expected to be required. These sites were used by DOE to investigate the process and environmental parameters of underground coal gasification technologies and were included in this analysis.

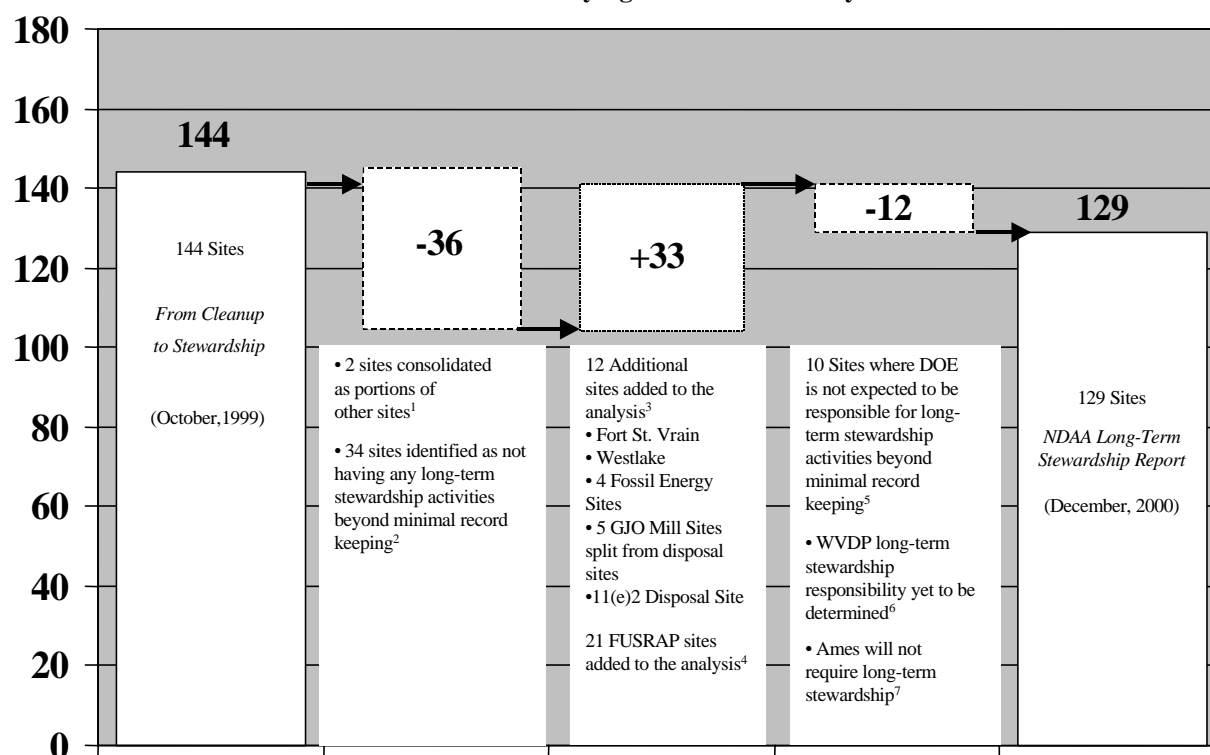
Fourth, for the purpose of this analysis, DOE determined that five of the UMTRCA Title I sites described in the *Background Report* should be divided into two sites each, based on the fact that the uranium mill tailings sites and the disposal cells are geographically distinct. The sites were separated, and as a result, five sites were added to the scope. These sites include the Durango Mill, Grand Junction Mill 1, Gunnison Mill, Lakeview Mill, and the Naturita Mill sites

Finally, 21 FUSRAP sites transferred to the Corps for remediation in 1997 were also added to the Report. Although the extent of long-term stewardship, if any, is unknown at this time, for the purpose of this Report, DOE assumes it may be responsible for long-term stewardship activities. These sites are included in Volume I discussions as part of the number of sites expected to require long-term stewardship. However, given the uncertainty regarding the extent of long-term stewardship, cost and acreage data were not provided. The addition of the 33 sites mentioned above combined with the 108 sites from the *Background Report* brings the total number of sites included in this Report to 141.

However, of the 141 sites, DOE identified 12 sites that are not within the scope of this Report for various reasons. These sites include:

- Ten out of 12 sites are excluded because although some long-term stewardship activities may be required after cleanup at these 10 sites, based on legally binding documents agreed to by all parties, DOE is not expected to be responsible for long-term stewardship activities at these sites.
- Long-term stewardship responsibility for the West Valley Demonstration Project in New York is yet to be determined.

Exhibit C-2. Identifying Sites for this Analysis



<sup>1</sup> Argonne National Laboratory-West (included as part of INEEL) and Oak Ridge Associated Universities (included as part of ORR) are within the geographic boundaries of other identified sites. Thus, unlike the *Background Report*, these sites are not counted as separate geographic sites.

<sup>2</sup> Thirty-four sites were removed because the Department does not expect that the sites will require any long-term stewardship, beyond record-keeping activities for the completed cleanup: Acid/Pueblo Canyons, Alba Craft, Aliquippa Forge, Albany Research Center, Associate Aircraft, Baker and Williams Warehouses, Baker Brothers, B&T Metals, Chapman Valve, C.H. Snoor, Chupadera Mesa, Elza Gate, General Motors, Geothermal Test Facility, Granite City Steel, Herring-Hall Marvin Safe Co., Holloman Air Force Base, Kauai Test Facility, Kellex/Pierpont, Middlesex Municipal Landfill, National Guard Armory, New Brunswick Site, Niagara Falls Storage Site Vicinity Properties, Oxnard Facility, Pagano Salvage Yard, Peak Oil PRP Participation, Project Chariot, Salton Sea Test Base, Separation Process Research Unit (SPRU), Seymour Speciality Wire, Shippingport, University of California, University of Chicago, and Ventron.

<sup>3</sup> The five uranium mill sites managed by the Grand Junction Office were split from their respective disposal sites because they represent geographically distinct sites. The Fort St. Vrain site was introduced by the Idaho Operations Office because the site will require DOE long-term stewardship activities where spent nuclear fuel is being stored. Similarly, four additional sites managed by the Office of Fossil Energy will require relatively limited long-term stewardship after cleanup. The Westlake Disposal Site in Missouri will also require long-term stewardship activities. The 11e.(2) Disposal Site will require long-term stewardship activities, however, the of long-term stewardship responsibility has yet to be determined.

<sup>4</sup> Twenty-one FUSRAP sites transferred to the Corps for remediation will be returned to DOE two years after the completion of cleanup. The extent of long-term stewardship for these sites, if any, is currently unknown. However, for the purpose of this Report, DOE assumes it may be responsible for long-term stewardship at all 21 sites: Combustion Engineering, CT; Madison, IL; W.R. Grace & Company, MD; Shpack Landfill, MS; Latty Avenue Properties, MO; St. Louis Airport Site and St. Louis Airport Vicinity Properties, MO; St. Louis Downtown Site, MO; DuPont & Company, NJ; Maywood Chemical Works, NJ; Middlesex Sampling Plant, NJ; Wayne Site, NJ; Ashland Oil #1 and #2, NY; Bliss and Laughlin Steel, NY; Colonie Site, NY; Linde Air Products, NY; Niagara Falls Storage Site, NY; Seaway Industrial Park, NY; Luckey, OH; and Painesville, OH.

<sup>5</sup> The 10 sites where DOE is not expected to be responsible for long-term stewardship activities are Ashtabula Environmental Management Project, OH; South Valley Site, NM; Energy Technology Engineering Center, CA; General Atomics, CA; General Electric Vallecitos Nuclear Center, CA; Maxey Flats Disposal Site, KY; Battelle Columbus King Avenue and West Jefferson Sites, OH; Laboratory for Energy-Related Health Research, CA; and the Westlake Disposal Site, MO.

<sup>6</sup> Currently, the final determination of the extent of and responsibility for long-term stewardship at the West Valley Demonstration Project (WVDP) in New York is yet to be determined.

<sup>7</sup> Ames Laboratory in Iowa is not expected to require long-term stewardship.



The Ames Laboratory is not included because no long-term stewardship activities are anticipated after scheduled remediation is completed in 2006 (i.e., clean closure of the site).

Because DOE is not expected to have long-term stewardship responsibility for the 12 sites mentioned above, they were not considered to be within the scope of this Report. However, brief descriptions of these sites are included in Volume II because DOE was involved in the cleanup.

In summary, as a result of this methodology, DOE identified a total of 129 sites where the Department will have long-term stewardship responsibility and, consequently, are included in the analysis in Volume I of this Report. (See Table 2-1). Volume II of this Report includes 141 site summaries, but provides more detailed long-term stewardship information for the 129 sites where DOE anticipates long-term stewardship responsibility.

#### **1.2.1.1 Portion(s) of a Site**

After the number of sites were determined, it was necessary to identify portions within each site to fulfill the intent of the Congressional language. For some larger sites, multiple portions were identified to provide increased detail of the long-term stewardship activities.

For the purpose of this Report, a portion of a site is defined as

*A geographically contiguous and distinct area for which cleanup, disposal, or stabilization has been completed or is expected to be completed by approximately the end of calendar year 2006 and where residual contamination remains. A portion may involve any or all of the following media: soil, groundwater, surface water/sediment, a facility, or an engineered unit. A portion can also be an aggregate of a number of facilities, soil sites, or engineered units that meet the following criteria: (1) all have similar contaminants; (2) they are closely located; and (3) all require similar long-term stewardship activities.<sup>49</sup>*

DOE Headquarters and Field staff worked closely and iteratively to identify the portions of sites that should be included as part of this analysis. In most cases, portions were based on site characteristics and the residual contamination expected within geographically distinct areas. Later in the process, the portion definition was refined to include a distinction between surface and subsurface. This distinction is particularly important for six of the former nuclear test sites: Rio Blanco and Rulison in Colorado, the Central Nevada Test Site and Project Shoal in Nevada, and Gasbuggy and Gnome-Coach in New Mexico. At these sites, surface remediation has been or will be completed well before the subsurface contamination characterization is complete. The surface and subsurface are each considered as a “portion.” This distinction is also important for 11 former mill tailing sites and 1 component fabrication facility (Pinellas STAR Center in Florida). It is important to note, however, that some sites were not divided into portions based on their size and/or type of anticipated long-term stewardship activities.

The purpose of dividing sites into “portions,” other than to comply with the explicit Congressional mandate, is to identify discrete subsets of sites that could be subject to distinct management attention. This interpretation was based partly on discussions with Congressional staff about the intent of the report language. Clearly, Congressional staff were interested in seeing evidence that DOE was actively considering how the sites would be managed after cleanup and making progress toward completion of cleanup. During

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<sup>49</sup> Guidance for the Development of the FY 2000 National Defense Authorization Act (NDAA) Long-Term Stewardship Report, January 24, 2000.

cleanup, sites are managed in units according to what makes sense to local site managers in order to accomplish local goals - generally to complete cleanup, disposal, or stabilization. However, after cleanup is complete, the “old” way of thinking about and managing the site (e.g., operable units, waste area groups) may no longer be the most appropriate for managing the long-term stewardship activities. Based on future uses of the site, managers may determine, for example, that portions of a site that are in close proximity to roads, rail lines, or other means of public access would have similar management needs that may differ from areas of a site that are more isolated. Even though the site may have been managed as a single operable unit for cleanup purposes, there may be a benefit to managing them as two “portions” for long-term stewardship -- one requiring more frequent inspections and monitoring to ensure that signs, fences, and other controls remain in place. Alternatively, DOE staff at some sites (e.g., Nevada Test Site) expect to continue non-EM missions long after the EM activities are completed at the sites, with no expectation for significant non-DOE use of the land. In theory, creating portions of the site based on the anticipated long-term stewardship activities could result in a new geographic division of sites that would better prepare the Department to manage the site after cleanup is completed.

In practice, dividing sites into portions for purposes of planning and managing expected long-term stewardship activities was neither easy nor straightforward. In some cases, site personnel could not provide information on expected land use after cleanup is completed. In most cases, no site personnel have been assigned responsibility for the post-cleanup management of portions of the site. Site personnel often provided information based on “areas” or other subsets of the site that may or may not be the basis for future organization of the site, but will likely be useful building blocks for any post-cleanup management scheme. The definition of “areas” and “portions” varied greatly among sites. Consequently, Volume I of this Report does not focus on this level of analysis. However, the site-specific summaries in Volume II provide detailed discussions of portions of sites, when applicable.

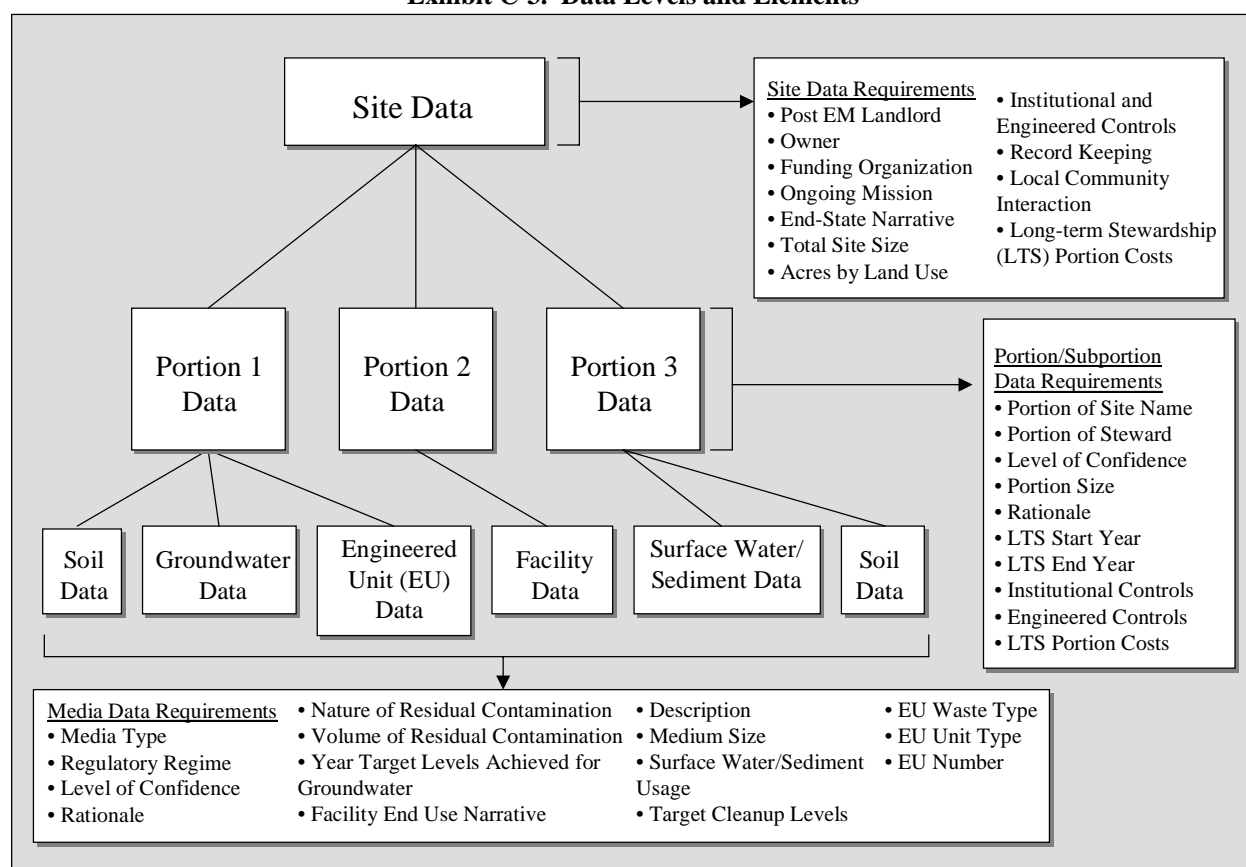
Because of the relative paucity and varying quality of information on some portions of sites, the DOE project team used supplemental information sources (e.g., Environmental Impact Statements, land use plans, etc.) to estimate the number of acres where residual contamination would remain and require long-term stewardship. See Section 7 of this Appendix and Chapter 3 of this Report for more details on this information and its compilation.

### **1.2.2 Developing the Guidance and Survey**

After DOE identified the sites and portions of sites that would be included in the analysis, the project team began developing a survey tool for collecting information on those sites and portions of sites from DOE Field staff. First, DOE determined the discrete data elements needed to provide a complete picture of the Department’s long-term stewardship requirements. The Department identified 36 data elements for collection at the site and portion levels. At the site level, general site information, including identifying the responsible parties, a summary of the site end-state, local community interactions, and long-term stewardship activities that are not associated with a specific portion was requested. At the portion level, portion-specific data elements were requested including a description of the portion, the portion size, start and end years for long-term stewardship, estimated costs, and the long-term stewardship activities associated with that portion. If no portions were identified for a given site, then the data to be collected at the portion level was applied to the entire site (i.e., for the purpose of the data collection effort, the sites were handled as a single geographic portion).

The project team also identified data elements on the environmental media where residual contamination would remain following planned remediation activities. Five media types were identified: soil, groundwater, engineered units (e.g., landfills) facilities, and surface water/sediments. The data elements and the data structure used in the survey are depicted in Exhibit C-3.

Exhibit C-3. Data Levels and Elements



To facilitate the data collection process (i.e., save time and money and improve communications), DOE staff developed an electronic tool so that Field personnel could submit their data directly into the database used for this analysis, developed a guidance document defining the data elements being requested, and developed a user's manual for the electronic tool. In addition, the project team established a hotline and a web-based question submittal process to address Field staff concerns or difficulties with the data tool on a real time basis. To ensure consistency in responses across sites, a comment response and tracking log was maintained.

### 1.3 DATA SUBMITTED, REVIEWED, AND REVISED

Once DOE Field staff submitted draft data, the Headquarters project team initiated an extensive data quality assurance review process that relied heavily upon the assistance of Headquarters programs. The review comments generated by various Headquarters reviews were provided back to Field staff for update. The review by Headquarters programs were focused on programmatic and policy issues. In some cases, the review process consisted of several iterations until the data provided were corrected.

#### *Stakeholder Involvement*

As with most public participation activities, each Field office determines the level and type of appropriate public participation. However, Headquarters strongly encouraged each Field office to involve the public in the development of the information provided to respond to the Congressional request. The specific process for stakeholder involvement in the data collection effort varied on a site-by-site basis.

For example, in some cases Field office staff provided local stakeholders and other interested parties, such

as regulators and state representatives with copies of the draft NDAA data collection guidance document and copies of the draft site summaries in Volume II. Discussions with stakeholders regarding the NDAA data draft site summaries occurred during forums such as Site-Specific Advisory Board meetings. Governor Sunquist of Tennessee explicitly raised this issue with the Secretary and included it in the text of the agreement signed at the 1999 Summit in Denver by both the Governor and the Secretary, which requires that the Department share the information with the State and stakeholders before it is reported to Congress. Other States also requested the same level of involvement as Tennessee.

#### **1.4 DRAFT REPORT PREPARED, REVIEWED, AND REVISED**

DOE used the data submitted from Field staff to obtain the summary statistics and analysis presented in Volume I of this Report to Congress. Volume II of this Report to Congress consists solely of the site-specific summaries developed for each site. The site summaries presented in Volume II are listed alphabetically by State.

The site-specific long-term stewardship summaries for Volume II of the Report were developed using the data collected as a starting point. These summaries provide a clear description of the site and the anticipated site end-state, the cleanup activities that will be undertaken to achieve that end-state, and the resulting long-term stewardship costs and activities. The amount of detail included in the site-specific summaries generally depends on various factors including, but not limited to, site cleanup status, site mission, and the site ownership.

Once the initial site summaries were developed, DOE initiated a review process similar to that used for the data review process. DOE Field staff reviewed the site summaries and provided additional or clarifying data when necessary. This review was a valuable part of the site summary development process because it ensured that Field-submitted data were properly interpreted during the writing process. DOE Headquarters and Field staff worked collaboratively on developing and improving the site summaries.

Detailed sites summaries were provided for 96 sites where DOE expects to have clear long-term stewardship responsibility by 2006 and where significant long-term stewardship information is available. These sites represent the primary focus of the report. Additionally, brief site summaries were also developed for the 33 sites where DOE may have long-term stewardship responsibility, but the extent of long-term stewardship is yet to be determined. The 33 sites include the 11 UMTRCA Title II sites, 21 FUSRAP sites, and WIPP. Brief site summaries are also provided for the 11 sites where DOE is not expected to have long-term stewardship responsibilities after completing remediation as a liable party.<sup>50</sup> Although long-term stewardship is not expected, a brief site summary for the Ames Laboratory in Iowa was also included because remediation at the site is ongoing. Each site summary includes a site description and discussion of the site mission, past contamination and cleanup activities, accomplishments achieved at the site, site-specific long-term stewardship activities, long-term stewardship costs, and assumptions and uncertainties. Also, DOE used site maps supplied by Field staff to complement the discussions.

#### ***Stakeholder Involvement***

As with the data submittal and review, each Field office determines the level and type of appropriate public participation for reviewing the draft report. As before, Headquarters strongly encouraged each Field office to involve the public in reviewing the Report. The specific process for stakeholder involvement in the data collection effort varied on a site-by-site basis.

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<sup>50</sup> Long-term stewardship responsibility for the West Valley Demonstration Project is yet to be determined.

## 1.5 CONCURRENCE AND APPROVAL BY DOE OPERATIONS OFFICES AND HEADQUARTERS PROGRAMS

After the draft Report was prepared, the document required a formal DOE concurrence process. Concurrence approval was received from each DOE Operations Office and each Headquarters Program. All comments were addressed and tracked in a database.

## 2.0 ASSUMPTIONS AND DATA LIMITATIONS

A number of assumptions, data limitations, and uncertainties are associated with the data collected for this analysis. Programmatic assumptions and data limitations are discussed below. Site-specific assumptions are provided in the site-specific summaries in Volume II of this Report to Congress.

### *Scope*

- Data provided for this Report are for planning purposes only and in no way preempt any ongoing or future regulatory or other decision-making processes.
- This Report is prepared based on the best available data to date (as of Spring - Summer 2000). In some cases, Field office staff do not know what the site end-state will be at the completion of cleanup and do not have a sufficiently clear estimate of the scope of long-term stewardship (i.e., the necessary long-term stewardship activities and expected costs) because site characterization has not been completed. As more characterization and final decisions are made, Field office staff will have more clearly defined long-term stewardship activities and cost estimates. Decisions about site end-state and cleanup assumptions will ultimately be made in accordance with the applicable statutes (i.e., RCRA, CERCLA, AEA), DOE Orders, and State and local requirements.
- Sites where DOE is identified as a potentially responsible party (PRP) and, therefore, participants in the cleanup, but where DOE is not expected to retain any long-term stewardship responsibilities, are not included in the summary results presented in Volume I of this Report to Congress (however, these sites are included in Volume II for informational purposes).
- This analysis includes any site or portion of a site that will require use restrictions as a result of residual contamination. This analysis does not include any sites or portions of a site where DOE Field staff and regulators determined there is no residual contamination or where contamination was remediated to levels that will allow for unrestricted use.
- An uncertain number of low-level radioactive waste sites under NWSA Section 151(b) and (c), which include low-level radioactive waste disposal sites and low-level radioactive waste sites at certain ore processing facilities, are excluded from this analysis because of the uncertainty regarding whether DOE will be responsible for long-term stewardship of these sites beyond those already identified as part of DOE's long-term stewardship responsibilities.
- The definition of what activities should be included in long-term stewardship differs from site to site.
- Changes in scientific understanding of the human health or environmental effects of residual contamination may result in changes to our regulatory standards, resulting in more or less stringent long-term stewardship activities in the future. Similarly, technology developments may enable additional contamination to be removed or change the nature of the long-term stewardship activities required.
- Long-term stewardship activities are linked to site cleanup and future use decisions. As these decisions

are finalized, the Department's long-term stewardship activities may change accordingly.

### *Schedule*

- The long-term stewardship process is dynamic and the specific activities at a site will change over time in response to both site-specific and external factors. These factors include regulatory changes, technology developments, demographic shifts, and changes in the contamination due to attenuation or ongoing remediation.

### *Cost*

- Long-term stewardship costs are based upon planned near-term cleanup funding levels. Changes in these funding levels could affect decisions regarding cleanup decisions and, consequently, the resulting end-state and long-term stewardship activities.
- Estimated long-term stewardship costs cover long-term stewardship activities through 2070 (DOE Environmental Management data sources currently track costs only to 2070), even though long-term stewardship activities may be required for a longer period, possibly in perpetuity.
- Cost estimates for activities occurring at sites where cleanup will be completed for the entire geographic site during the near-term time period (i.e., through 2006) are more accurate than the longer-range planning estimates for the out years (i.e., after 2006).
- For sites where cleanup of the entire site has not been completed and no long-term stewardship plan has been prepared, existing data are largely organized according to DOE project rather than by geographic area. Consequently, the information submitted by Field staff do not describe expected long-term stewardship costs and activities at the geographic portion level.
- Although costs for long-term stewardship at the site-specific level appear to be more comprehensive than in past reports, it is still difficult, if not impossible to draw comparisons of costs for long-term stewardship activities between sites. Sites include and report long-term stewardship activities in their budgets differently.

## **3.0 METHOD FOR IDENTIFYING ACRES LIKELY TO REQUIRE LONG-TERM STEWARDSHIP AT DOE SITES**

The purpose of long-term stewardship is to protect human health and the environment from the hazards remaining at the sites. One way to measure the size of the Department's long-term stewardship responsibility is to estimate the amount of land likely to be affected because of residual surface or subsurface contamination. Depending on the nature of the remaining hazards, these lands will, at a minimum, be subject to monitoring, record-keeping requirements, and land use restrictions. This section discusses the amount of land affected at the 129 sites where DOE expects to perform long-term stewardship activities.

Approximately 539,000 acres (more than 21 percent) of the land is contaminated. To refine the estimated extent of residually contaminated lands and DOE's expected long-term stewardship requirements, the Headquarters' project team attempted to collect data at a level of detail not previously requested from Field staff. In addition to collecting the total acreage of the geographic sites, the Headquarters project team requested the Field staff to submit the number of acres for distinct portions of sites where cleanup activities are expected to be complete by 2006 and long-term stewardship has begun.

Because each DOE site is unique, portions were defined on a site-specific basis. The portions are not always

defined to be exact representations of the extent of residually contaminated areas, but rather may reflect land use controls in place for other reasons. For example:

- **Buffer Zone:** This land is clean, but the land has use or access restrictions similar to contaminated areas to reduce the risk of exposure to humans and the environment. Several sites are required to have buffer areas as a means of spatial separation between humans and areas of residual contamination.
- **Wildlife Areas:** Other sites have defined portions of sites based upon ecological management.
- **Areas Surrounded by Contamination:** Some sites have scattered areas (“islands”) of contamination. The land in between these areas of contamination is often clean. However, for more efficient management purposes, the land is managed as a contiguous unit. The entire area is subject to land use control.

For the purpose of reporting lands currently subject to long-term stewardship and those expected to require long-term stewardship by 2006, the NDAA Data Call information provided a reasonable estimate of acreage. The NDAA Data Call information was used for portion acreage as a proxy for long-term stewardship acreage. As previously discussed, portions were partly defined to follow long-term stewardship boundaries and areas of residual contamination, but this was not always the case. The scope of the Report to Congress and the use of portion acreage limits the usefulness of acreage data for two type of sites:

- Sites where portions were much larger than the actual area of contamination (see above: buffer zone, wildlife areas, areas surrounded by contamination).
- Large sites not scheduled to complete cleanup activities until well after 2006.

Therefore, a number of key assumptions were made to compensate for the information shortcomings. To address portions that are much larger than the actual area of contamination, the surface areas of contaminated media were used. The surface area of contaminated media (soil, groundwater, surface water/sediment, engineered units, and facilities) was collected in the NDAA Data Call to provide a more exact reference to areas of residual contamination. This collection affected three portions at the Hanford Site, which are wildlife areas:

- The Wahluke Slope was assumed to be 518 acres of contaminated soil rather than 88,000 acres, which is an ecological management unit.
- The Arid Land Ecology Reserve was assumed to be two acres of soil contamination rather than the 76,000 acres, which is an ecological management unit.
- The Riverlands was assumed to be five acres of soil contamination rather than 8,600 acres, which is an ecological management unit.

Because the NDAA Data Call focused on sites or portions of sites to be complete by 2006, many large sites scheduled to have ongoing remediation well into the future were not adequately represented for long-term stewardship acreage. To compensate for the scope of the Report to Congress, assumptions were made for the Idaho Engineering and Environmental Laboratory, the Nevada Test Site, and the Savannah River Site. External data sources were required for this information. The assumptions used in the acreage assessments (Exhibits 3-7 and 3-8) are as follows:

- In 2018 (when the site remediation is scheduled to be complete), 23,000 acres were added for the Nevada Test Site to fully account for surface plutonium contamination (if regulatory limits are 40

PiCu/g) not captured in the Report to Congress.<sup>51</sup>

- In 2030 (when the site remediation is scheduled to be complete), 21,000 acres were inserted for the Savannah River Site to fully account for contaminated industrial areas, infrastructure, and ponds not captured in the Report to Congress.<sup>52</sup>
- In 2050 (when the site remediation is scheduled to be complete), 10,000 acres were inserted for the Idaho Engineering and Environmental Laboratory to account for planned, environmentally-controlled areas, not captured in the Report to Congress.<sup>53</sup>

*Other key assumptions:*

- The Idaho Engineering and Environmental Laboratory's Ordnance Area is the single largest contiguous area subject to long-term stewardship, covering nearly 210,000 acres. This portion is not entirely contaminated and contains "islands" of clean land. However, the area has not been fully characterized, and it is difficult to know the exact extent of contamination. Additionally, the entire area has access restrictions. Therefore, the entire 210,000 acres are considered to be subject to long-term stewardship activities.
- Amchitka Island is 74,000 acres. The area of contamination and associated use restrictions is considerably smaller than the size of the entire island. However, characterization of the island is not complete. Until spatial information can be updated, the Amchitka Island site will be treated as a 74,000 acres site subject to long-term stewardship.
- Acreage for the 21 FUSRAP sites transferred to the Corps in 1997 for remediation were not included in the land-use estimates because the extent of long-term stewardship is currently unknown.

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<sup>51</sup> "Cost/Risk/Benefits Analysis of Alternative Clean-up Requirements for Plutonium Contaminated Soils on and Near the Nevada Test Site", DOE/NV-399, May 1995.

<sup>52</sup> Data for the Savannah River Site are based on the assumption that five percent of the site acreage is developed and will require access restrictions.

<sup>53</sup> "The Idaho National Engineering and Environmental Laboratory Land Use Plan," 1996.



## APPENDIX D: SITE LISTS BY CLEANUP COMPLETION YEAR<sup>54</sup>

This appendix organizes the 129 sites (entire site or portion of a site) where DOE may have long-term stewardship responsibility into four tables based on remediation completion year.

**Table D-1. Remediation of Entire Site Complete by End of 2000**

<i>State</i>	<i>Site Name</i>	<i>Site Type*</i>
California	Sandia National Laboratories-CA	Research, Development, & Testing
Colorado	Bodo Canyon Cell	Uranium Mining, Milling, & Refining
	Burro Canyon Disposal Cell	Uranium Mining, Milling, & Refining
	Cheney Disposal Cell	Uranium Mining, Milling, & Refining
	Estes Gulch Disposal Cell	Uranium Mining, Milling, & Refining
	Fort St. Vrain	Other
	Gunnison Disposal Cell	Uranium Mining, Milling, & Refining
	Maybell Mill Site	Uranium Mining, Milling, & Refining
	Naturita Site	Uranium Mining, Milling, & Refining
	Naval Oil Shale Reserves Site	Fossil Energy
Idaho	Lowman Site	Uranium Mining, Milling, & Refining
Illinois	Fermi National Accelerator Laboratory	Research, Development, & Testing
	Palos Forest (Site A/Plot M) Preserve	Other
Nebraska	Hallam Nuclear Power Facility	Other
New Jersey	Princeton Plasma Physics Laboratory	Research, Development, & Testing
New Mexico	Ambrosia Lake Site	Uranium Mining, Milling, & Refining
	Bayo Canyon	Other
	Bluewater Site	Uranium Mining, Milling, & Refining
	Lovelace Respiratory Research Institute	Research, Development, & Testing
Ohio	Piqua Nuclear Power Facility	Other
Oregon	Lakeview Mill	Uranium Mining, Milling, & Refining
	Lakeview Site	Uranium Mining, Milling, & Refining
Pennsylvania	Burrell Site	Uranium Mining, Milling, & Refining
	Canonsburg Site	Uranium Mining, Milling, & Refining
Puerto Rico	Center for Energy and Environmental Research	Research, Development, & Testing
South Dakota	Edgemont Site	Uranium Mining, Milling, & Refining
Texas	Falls City Site	Uranium Mining, Milling, & Refining
Utah	Mexican Hat Site	Uranium Mining, Milling, & Refining
	Salt Lake City Mill	Uranium Mining, Milling, & Refining

<sup>54</sup> In some cases, the cleanup of the site's surface has been completed, but subsurface remediation (e.g., groundwater characterization and cleanup) has not yet been completed. For the purpose of this Report, completed surface remediation requiring long-term stewardship is identified separately from the long-term stewardship required for subsurface contamination. The long-term stewardship activities for the entire site (i.e., both surface and subsurface) may be managed and budgeted as part of ongoing cleanup activities, rather than as distinct activities.

**Table D-1. Remediation of Entire Site Complete by End of 2000**

<i>State</i>	<i>Site Name</i>	<i>Site Type*</i>
	South Clive Disposal Cell	Uranium Mining, Milling, & Refining
Washington	(WNI) Sherwood Site	Uranium Mining, Milling, & Refining
West Virginia	Parkersburg Site	Other
Wyoming	Riverton Site	Uranium Mining, Milling, & Refining
	Spook Site	Uranium Mining, Milling, & Refining
<b>Subtotal of entire sites to have completed remediation by the end of 2000:</b>		<b>34</b>

\* Site Type is referenced from *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences*, DOE/EM #97-2392, January 1997.

**Table D-2. Remediation of Entire Site Expected to be Complete by End of 2006**

State	Site Name	Site Type*
Alaska	Amchitka Island	Research, Development, & Testing
California	Lawrence Berkeley National Laboratory	Research, Development, & Testing
	Stanford Linear Accelerator	Research, Development, & Testing
Colorado	Grand Junction Mill 1	Uranium Mining, Milling, & Refining
	Grand Junction Mill 2	Uranium Mining, Milling, & Refining
	Gunnison Mill	Uranium Mining, Milling, & Refining
	(HECLA) Durita Site	Uranium Mining, Milling, & Refining
	Rocky Flats Environmental Technology Site	Component Fabrication
	(UMETCO) Maybell Site 2	Uranium Mining, Milling, & Refining
Illinois	Argonne National Laboratory East	Research, Development, & Testing
Mississippi	Salmon Site	Research, Development, & Testing
Missouri	Kansas City Plant	Component Fabrication
	Weldon Spring Site	Uranium Mining, Milling, & Refining
New Mexico	(SOHIO) LBAR Site	Uranium Mining, Milling, & Refining
	Sandia National Laboratories - NM	Research, Development, & Testing/Weapons Operations
Ohio	Miamisburg Environmental Management Project	Component Fabrication
Texas	(Chevron) Panna Maria Site	Uranium Mining, Milling, & Refining
	(Conoco) Conquista Site	Uranium Mining, Milling, & Refining
	(Exxon) Ray Point Site	Uranium Mining, Milling, & Refining
	Pantex Plant	Component Fabrication/Weapons Operations
Utah	(Atlas) Moab Mill	Uranium Mining, Milling, & Refining
	Monticello Mill Site and Vicinity Properties	Uranium Mining, Milling, & Refining
Wyoming	(ANC) Gas Hills Site	Uranium Mining, Milling, & Refining
	(Exxon) Highlands Site	Uranium Mining, Milling, & Refining
	Hoe Creek Underground Coal Gasification Site	Fossil Energy
	Naval Petroleum Reserve No. 3 Landfill/Landfarm	Fossil Energy
	(Pathfinder) Lucky Mc Site	Uranium Mining, Milling, & Refining
	(Pathfinder) Shirley Basin Site 2	Uranium Mining, Milling, & Refining
	(Petrochemicals) Shirley Basin Site 1	Uranium Mining, Milling, & Refining
	Rock Springs Oil Shale Retort Site	Fossil Energy
	(UMETCO) Gas Hills Site	Uranium Mining, Milling, & Refining
	(Union Pacific) Bear Creek Site	Uranium Mining, Milling, & Refining
	(WNI) Split Rock Site	Uranium Mining, Milling, & Refining
<b>Subtotal of entire sites expected to have completed remediation by 2006:</b>		<b>33</b>

\* Site Type is referenced from *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences*, DOE/EM #97-2392, January 1997.



**Table D-3. Remediation of Entire Site Expected to be Partially Complete (Portion(s) Complete) by End of 2006**

<i>State</i>	<i>Site Name</i>	<i>Site Type*</i>
Arizona	Monument Valley Site <sup>a</sup>	Uranium Mining, Milling, & Refining
	Tuba City Site <sup>a</sup>	Uranium Mining, Milling, & Refining
California	Lawrence Livermore National Laboratory - Livermore Site	Research, Development, & Testing
	Lawrence Livermore National Laboratory - Site 300	Research, Development, & Testing
New York	Brookhaven National Laboratory	Research, Development, & Testing
Colorado	Durango Mill <sup>a</sup>	Uranium Mining, Milling, & Refining
	Naturita Mill <sup>a</sup>	Uranium Mining, Milling, & Refining
	Rifle (New) Mill <sup>a</sup>	Uranium Mining, Milling, & Refining
	Rifle (Old) Mill <sup>a</sup>	Uranium Mining, Milling, & Refining
	Rio Blanco <sup>a</sup>	Research, Development, & Testing
	Rulison <sup>a</sup>	Research, Development, & Testing
	Slick Rock (North Continent) Mill 1 <sup>a</sup>	Uranium Mining, Milling, & Refining
	Slick Rock (Union Carbide) Mill 2 <sup>a</sup>	Uranium Mining, Milling, & Refining
Florida	Pinellas STAR Center <sup>b</sup>	Component Fabrication
Idaho	Idaho National Engineering and Environmental Laboratory	Chemical Separation
Kentucky	Paducah Gaseous Diffusion Plant	Isotope Separation
Nevada	Central Nevada Test Area <sup>a</sup>	Research, Development, & Testing
	Nevada Test Site <sup>c</sup>	Research, Development, & Testing
	Project Shoal <sup>a</sup>	Research, Development, & Testing
New Mexico	Gasbuggy Site <sup>a</sup>	Research, Development, & Testing
	Gnome-Coach <sup>a</sup>	Research, Development, & Testing
	Los Alamos National Laboratory	Research, Development, & Testing/Weapons Operations/Component Fabrication
	Shiprock Site <sup>a</sup>	Uranium Mining, Milling, & Refining
Ohio	Fernald Environmental Management Project	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	Portsmouth Gaseous Diffusion Plant	Isotope Separation
South Carolina	Savannah River Site	Fuel & Target Fabrication (deactivation only)
Tennessee	Oak Ridge Reservation	Isotope Separation/Production Reactor Operations/Component Fabrication
Utah	Green River Site <sup>a</sup>	Uranium Mining, Milling, & Refining
Washington	Hanford Site	Fuel & Target Fabrication/Production Reactor Operations/Chemical Separations/Component Fabrication
<b>Subtotal of entire sites expected to be partially complete by 2006:</b>		<b>29</b>

\* Site Type is referenced from *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences*, DOE/EM #97-2392, January 1997.

<sup>a</sup> For the remediation of sites, DOE distinguishes the surface from subsurface activity. The long-term stewardship start date reflects

the completion of surface remediation. However, characterization of subsurface contamination will continue well beyond 2006. Therefore, this site is considered to be partially complete by 2006.

<sup>b</sup> Surface cleanup activities were completed in 1999 to unrestricted use. No active long-term stewardship activities are being performed or planned for the surface other than record-keeping activities. However, groundwater remediation is ongoing and is anticipated to continue until 2014. Therefore, this site is considered to be partially complete by 2006.

<sup>c</sup> The indicated date reflects when all soil sites are planned to be remediated and long-term stewardship activities are expected to be performed for the soil sites. However, significant remediation progress has been made at the site that currently requires some level of long-term stewardship activities.

**Table D-4. Sites Where DOE May Be Responsible for Long-Term Stewardship,  
if Long-Term Stewardship is Required\***

<i>State</i>	<i>Site Name</i>	<i>Site Type**</i>
Colorado	(Cotter) Cañon City Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	(UMETCO) Uravan Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
Connecticut	CE	FUSRAP
Illinois	Madison	FUSRAP
Maryland	W.R. Grace and Company	FUSRAP
Massachusetts	Shpack Landfill	FUSRAP
Missouri	Latty Avenue Properties	FUSRAP
	St. Louis Airport Site	FUSRAP
	St. Louis Airport Site Vicinity Properties	FUSRAP
	St. Louis Downtown Site	FUSRAP
New Jersey	DuPont & Company	FUSRAP
	Maywood Chemical Works	FUSRAP
	Middlesex Sampling Plant	FUSRAP
	Wayne Site	FUSRAP
New Mexico	(Homestake) Grants Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	(Quivira) Ambrosia Lake Site 2	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	(UNC) Church Rock Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	Waste Isolation Pilot Plant	Repository
New York	Ashland Oil #1	FUSRAP
	Ashland Oil #2	FUSRAP
	Bliss and Laughlin Steel	FUSRAP
	Colonie	FUSRAP
	Linde Air Products	FUSRAP
	Niagara Falls Storage Site	FUSRAP
	Seaway Industrial Park	FUSRAP
Ohio	Luckey	FUSRAP
	Painesville	FUSRAP
Utah	(EFN) White Mesa Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	(Plateau) Shootaring Canyon Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	(Rio Algom) Lisbon Valley Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
	11 (e) 2 Disposal Site	Disposal Site

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<i>State</i>	<i>Site Name</i>	<i>Site Type**</i>
Washington	(Dawn) Ford Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
Wyoming	(Kennebecott) Sweetwater Site	Uranium Mining, Milling, & Refining/Fuel & Target Fabrication
<b>Subtotal of sites where DOE anticipates long-term stewardship responsibility after 2006:</b>		<b>33</b>
<b>Total number of sites:</b>		<b>129</b>

\* Cleanup responsibility for these 21 FUSRAP sites has been assigned to the U.S. Army Corps of Engineers. DOE and the Corps signed a Memorandum of Understanding (MOU) in March 1999, that assigns responsibility to DOE for any required long-term stewardship. However, cleanup decisions for these sites are not yet final, and, therefore, the level of long-term stewardship required for these sites, if any, is not yet known. For the purpose of this Report, all 21 FUSRAP sites are categorized along with 12 additional sites where DOE may be responsible for long-term stewardship activities (see Section 3.2).

\*\* Site Type is referenced from *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences*, DOE/EM #97-2392, January 1997.



# APPENDIX E: PROJECTED LONG-TERM STEWARDSHIP COSTS FOR YEARS 2000, 2006, AND 2050\*

Appendix E provides a simple summary of expected costs by providing a “snapshot” of the costs for each site for years 2000, 2006, and 2050. As discussed in Section 3.4, the analysis for this Report focuses on cost data reported for 2000 through 2006. Annual costs for 2050 are shown in this appendix, but are considered rough estimates. These tables are provided in Appendix E: Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050, Table E-2. Long-Term Stewardship Costs by Site for Years 2000, 2006, and 2050 (by Site), Table E-3. Long-Term Stewardship Costs by Operations/Program Office for Years 2000, 2006, and 2050.

**Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
<b>Alaska Sites</b>	<b>0</b>	<b>Alaska Sites</b>	<b>0</b>	<b>Alaska Sites</b>	<b>0</b>
Amchitka Island	0	Amchitka Island	0	Amchitka Island	43
<b>Arizona Sites</b>	<b>33</b>	<b>Arizona Sites</b>	<b>63</b>	<b>Arizona Sites</b>	<b>33</b>
Tuba City Site	33	Tuba City Site	63	Tuba City Site	35
Monument Valley Site	0	Monument Valley Site	0	Monument Valley Site	30
<b>California Sites</b>	<b>84</b>	<b>California Sites</b>	<b>1,763</b>	<b>California Sites</b>	<b>338</b>
Sandia National Laboratories - CA	84	Lawrence Berkeley National Laboratory	1,179	Lawrence Livermore National Laboratory - Livermore Site	140
Lawrence Berkeley National Laboratory	0	Stanford Linear Accelerator	500	Stanford Linear Accelerator	100
Lawrence Livermore National Laboratory - Livermore Site	0	Sandia National Laboratories - CA	84	Sandia National Laboratories - CA	84
Lawrence Livermore National Laboratory - Site 300	0	Lawrence Livermore National Laboratory - Livermore Site	0	Lawrence Livermore National Laboratory - Site 300	14
Stanford Linear Accelerator	0	Lawrence Livermore National Laboratory - Site 300	0	Lawrence Berkeley National Laboratory	0
<b>Colorado Sites</b>	<b>3,947</b>	<b>Colorado Sites</b>	<b>3,992</b>	<b>Colorado Sites</b>	<b>6,633</b>
Fort St. Vrain	3,000	Fort St. Vrain	3,000	Rocky Flats Environmental Technology Site	5,959
Cheney Disposal Cell	575	Cheney Disposal Cell	439	(Cotter) Cañon City Site	171
Bodo Canyon Cell	107	Grand Junction Mill 2	121	Grand Junction Mill 2	128
Burro Canyon Disposal Cell	64	Bodo Canyon Cell	119	Rio Blanco	54
Grand Junction Mill 1	50	Burro Canyon Disposal Cell	63	Rulison	54
Gunnison Disposal Cell	37	Gunnison Disposal Cell	40	(UMETCO) Uravan Site	51
Rio Blanco	27	Rio Blanco	40	Bodo Canyon Cell	50

Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050

FY 2000		FY 2006		FY 2050**	
Site	Cost (in 000s)	Site	Cost (in 000s)	Site	Cost (in 000s)
Rulison	27	Rulison	40	Burro Canyon Disposal Cell	26
Estes Gulch Disposal Cell	24	Estes Gulch Disposal Cell	36	Maybell Mill Site	26
Naturita Site	23	Maybell Mill Site	26	(UMETCO) Maybell Site 2	26
(HECLA) Durita Site	4	(UMETCO) Maybell Site 2	26	Cheney Disposal Cell	24
(UMETCO) Maybell Site 2	4	Naturita Site	24	Gunnison Disposal Cell	16
Naval Oil Shale Reserves Site	3	(HECLA) Durita Site	11	Estes Gulch Disposal Cell	14
Maybell Mill Site	2	Grand Junction Mill 1	4	(HECLA) Durita Site	10
(Cotter) Cañon City Site	0	Naval Oil Shale Reserves Site	3	Naturita Site	9
Durango Mill	0	(Cotter) Cañon City Site	0	Grand Junction Mill 1	5
Grand Junction Mill 2	0	Durango Mill	0	Naval Oil Shale Reserves Site	4
Gunnison Mill	0	Gunnison Mill	0	Slick Rock (North Continent) Mill 1	2
Naturita Mill	0	Naturita Mill	0	Durango Mill	1
Rifle (New) Mill	0	Rifle (New) Mill	0	Naturita Mill	1
Rifle (Old) Mill	0	Rifle (Old) Mill	0	Rifle (New) Mill	1
Rocky Flats Environmental Technology Site	0	Rocky Flats Environmental Technology Site	0	Slick Rock (Union Carbide) Mill 2	1
Slick Rock (North Continent) Mill 1	0	Slick Rock (North Continent) Mill 1	0	Fort St. Vrain	0
Slick Rock (Union Carbide) Mill 2	0	Slick Rock (Union Carbide) Mill 2	0	Gunnison Mill	0
(UMETCO) Uravan Site	0	(UMETCO) Uravan Site	0	Rifle (Old) Mill	0
<b>Florida Sites</b>	<b>0</b>	<b>Florida Sites</b>	<b>0</b>	<b>Florida Sites</b>	<b>0</b>
Pinellas STAR Center	0	Pinellas STAR Center	0	Pinellas STAR Center	0
<b>Idaho Sites</b>	<b>40</b>	<b>Idaho Sites</b>	<b>4,259</b>	<b>Idaho Sites</b>	<b>2,424</b>
Lowman Site	40	Idaho National Engineering and Environmental Laboratory	4,200	Idaho National Engineering and Environmental Laboratory	2,400
Idaho National Engineering and Environmental Laboratory	0	Lowman Site	59	Lowman Site	24
<b>Illinois Sites</b>	<b>320</b>	<b>Illinois Sites</b>	<b>733</b>	<b>Illinois Sites</b>	<b>170</b>
Palos Forest (Site A/Plot M) Preserve	170	Argonne National Laboratory East	413	Palos Forest (Site A/Plot M) Preserve	170
Fermi National Accelerator Laboratory	150	Palos Forest (Site A/Plot M) Preserve	170	Argonne National Laboratory East	0

Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050

FY 2000		FY 2006		FY 2050**	
Site	Cost (in 000s)	Site	Cost (in 000s)	Site	Cost (in 000s)
Argonne National Laboratory East	0	Fermi National Accelerator Laboratory	150	Fermi National Accelerator Laboratory	0
<b>Kentucky Sites</b>	<b>6,599</b>	<b>Kentucky Sites</b>	<b>4,757</b>	<b>Kentucky Sites</b>	<b>8,716</b>
Paducah Gaseous Diffusion Plant	6,599	Paducah Gaseous Diffusion Plant	4,757	Paducah Gaseous Diffusion Plant	8,716
<b>Mississippi Sites</b>	<b>180</b>	<b>Mississippi Sites</b>	<b>40</b>	<b>Mississippi Sites</b>	<b>55</b>
Salmon Site	180	Salmon Site	40	Salmon Site	55
<b>Missouri Sites</b>	<b>0</b>	<b>Missouri Sites</b>	<b>2,510</b>	<b>Missouri Sites</b>	<b>2,275</b>
Kansas City Plant	0	Kansas City Plant	1,504	Kansas City Plant	1,269
Weldon Spring Site	0	Weldon Spring Site	1,006	Weldon Spring Site	1,006
<b>Nebraska Sites</b>	<b>44</b>	<b>Nebraska Sites</b>	<b>31</b>	<b>Nebraska Sites</b>	<b>32</b>
Hallam Nuclear Power Facility	44	Hallam Nuclear Power Facility	31	Hallam Nuclear Power Facility	32
<b>Nevada Sites</b>	<b>2,056</b>	<b>Nevada Sites</b>	<b>2,235</b>	<b>Nevada Sites</b>	<b>3,043</b>
Nevada Test Site	2,023	Nevada Test Site	2,155	Nevada Test Site	2,934
Central Nevada Test Area	17	Central Nevada Test Area	40	Project Shoal	55
Project Shoal	16	Project Shoal	40	Central Nevada Test Area	54
<b>New Jersey Sites</b>	<b>273</b>	<b>New Jersey Sites</b>	<b>281</b>	<b>New Jersey Sites</b>	<b>0</b>
Princeton Plasma Physics Laboratory	273	Princeton Plasma Physics Laboratory	281	Princeton Plasma Physics Laboratory	0
<b>New Mexico Sites</b>	<b>316</b>	<b>New Mexico Sites</b>	<b>1,393</b>	<b>New Mexico Sites</b>	<b>12,519</b>
Lovelace Respiratory Research Institute	140	Sandia National Laboratories - NM	1,000	Waste Isolation Pilot Plant	10,556
Shiprock Site	57	Lovelace Respiratory Research Institute	140	Sandia National Laboratories - NM	920
Bluewater Site	41	Shiprock Site	103	Los Alamos National Laboratory	700
Gasbuggy Site	28	Gasbuggy Site	40	Gasbuggy Site	59
Gnome-Coach	28	Gnome-Coach	40	Shiprock Site	59
(SOHIO) LBAR Site	17	(SOHIO) LBAR Site	35	Gnome-Coach	54
Ambrosia Lake Site	4	Ambrosia Lake Site	21	(UNC) Church Rock Site	43
Bayo Canyon	1	Bluewater Site	13	(Quivira) Ambrosia Lake Site 2	34
(Homestake) Grants Site	0	Bayo Canyon	1	(SOHIO) LBAR Site	34
Los Alamos National Laboratory	0	(Homestake) Grants Site	0	(Homestake) Grants Site	26
(Quivira) Ambrosia Lake Site 2	0	Los Alamos National Laboratory	0	Ambrosia Lake Site	20

**Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Sandia National Laboratories - NM	0	(Quivira) Ambrosia Lake Site 2	0	Bluewater Site	13
(UNC) Church Rock Site	0	(UNC) Church Rock Site	0	Bayo Canyon	1
Waste Isolation Pilot Plant	0	Waste Isolation Pilot Plant	0	Lovelace Respiratory Research Institute	0
<b>New York Sites</b>	<b>0</b>	<b>New York Sites</b>	<b>0</b>	<b>New York Sites</b>	<b>0</b>
Brookhaven National Laboratory	0	Brookhaven National Laboratory	0	Brookhaven National Laboratory	0
<b>Ohio Sites</b>	<b>6,784</b>	<b>Ohio Sites</b>	<b>6,059</b>	<b>Ohio Sites</b>	<b>3,373</b>
Portsmouth Gaseous Diffusion Plant	6,764	Portsmouth Gaseous Diffusion Plant	6,041	Fernald Environmental Management Project	1,928
Piqua Nuclear Power Facility	20	Piqua Nuclear Power Facility	18	Portsmouth Gaseous Diffusion Plant	1,395
Fernald Environmental Management Project	0	Fernald Environmental Management Project	0	Miamisburg Environmental Management Project	50
Miamisburg Environmental Management Project	0	Miamisburg Environmental Management Project	0	Piqua Nuclear Power Facility	0
<b>Oregon Sites</b>	<b>376</b>	<b>Oregon Sites</b>	<b>83</b>	<b>Oregon Sites</b>	<b>36</b>
Lakeview Mill	260	Lakeview Site	83	Lakeview Site	34
Lakeview Site	116	Lakeview Mill	0	Lakeview Mill	2
<b>Pennsylvania</b>	<b>634</b>	<b>Pennsylvania</b>	<b>102</b>	<b>Pennsylvania</b>	<b>41</b>
Canonsburg Site	577	Canonsburg Site	62	Canonsburg Site	25
Burrell Site	57	Burrell Site	40	Burrell Site	16
<b>Puerto Rico Sites</b>	<b>25</b>	<b>Puerto Rico Sites</b>	<b>25</b>	<b>Puerto Rico Sites</b>	<b>25</b>
Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25
<b>South Carolina Sites</b>	<b>35,011</b>	<b>South Carolina Sites</b>	<b>25,779</b>	<b>South Carolina Sites</b>	<b>5,607</b>
Savannah River Site***	35,011	Savannah River Site***	25,779	Savannah River Site***	5,607
<b>South Dakota Sites</b>	<b>11</b>	<b>South Dakota Sites</b>	<b>7</b>	<b>South Dakota Sites</b>	<b>7</b>
Edgemont Site	11	Edgemont Site	7	Edgemont Site	7
<b>Tennessee Sites</b>	<b>6,394</b>	<b>Tennessee Sites</b>	<b>7,508</b>	<b>Tennessee Sites</b>	<b>15,987</b>
Oak Ridge Reservation	6,394	Oak Ridge Reservation	7,508	Oak Ridge Reservation	15,987
<b>Texas Sites</b>	<b>107</b>	<b>Texas Sites</b>	<b>1,605</b>	<b>Texas Sites</b>	<b>1,669</b>
Falls City Site	82	Pantex Plant	1,374	Pantex Plant	1,513
(Exxon) Ray Point Site	15	Falls City Site	118	(Conoco) Conquista Site	51
(Chevron) Panna Maria Site	5	(Conoco) Conquista Site	52	Falls City Site	45
(Conoco) Conquista Site	5	(Chevron) Panna Maria Site	35	(Chevron) Panna Maria Site	34
Pantex Plant	0	(Exxon) Ray Point Site	26	(Exxon) Ray Point Site	26

Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050

FY 2000		FY 2006		FY 2050**	
Site	Cost (in 000s)	Site	Cost (in 000s)	Site	Cost (in 000s)
<b>Utah Sites</b>	<b>257</b>	<b>Utah Sites</b>	<b>743</b>	<b>Utah Sites</b>	<b>696</b>
Mexican Hat Site	118	Monticello Mill Site and Vicinity Properties	510	Monticello Mill Site and Vicinity Properties	520
Salt Lake City Mill	84	Mexican Hat Site	113	Mexican Hat Site	45
Green River Site	41	Green River Site	75	Green River Site	28
South Clive Disposal Cell	14	South Clive Disposal Cell	28	(EFN) White Mesa Site	26
(Atlas) Moab Mill	0	(Atlas) Moab Mill	17	(Rio Algom) Lisbon Valley Site	26
(EFN) White Mesa Site	0	(EFN) White Mesa Site	0	(Plateau) Shootaring Canyon Site	24
Monticello Mill Site and Vicinity Properties	0	(Plateau) Shootaring Canyon Site	0	(Atlas) Moab Mill	16
(Plateau) Shootaring Canyon Site	0	(Rio Algom) Lisbon Valley Site	0	South Clive Disposal Cell	11
(Rio Algom) Lisbon Valley Site	0	Salt Lake City Mill	0	Salt Lake City Mill	0
11(2)e Disposal Site	0	11(2)e Disposal Site	0	11(2)e Disposal Site	0
<b>Washington Sites</b>	<b>100</b>	<b>Washington Sites</b>	<b>97</b>	<b>Washington Sites</b>	<b>36,921</b>
(WNI) Sherwood Site	53	Hanford Site	62	Hanford Site	36,716
Hanford Site	47	(WNI) Sherwood Site	35	(Dawn) Ford Site	171
(Dawn) Ford Site	0	(Dawn) Ford Site	0	(WNI) Sherwood Site	34
<b>West Virginia Sites</b>	<b>16</b>	<b>West Virginia Sites</b>	<b>15</b>	<b>West Virginia Sites</b>	<b>18</b>
Parkersburg Site	16	Parkersburg Site	15	Parkersburg Site	18
<b>Wyoming Sites</b>	<b>36</b>	<b>Wyoming Sites</b>	<b>897</b>	<b>Wyoming Sites</b>	<b>290</b>
(Union Pacific) Bear Creek Site	19	Rock Springs Oil Shale Retort Site	334	(Pathfinder) Lucky Mc Site	34
Spook Site	13	Hoe Creek Underground Coal Gasification Site	273	(Pathfinder) Shirley Basin Site 2	34
(ANC) Gas Hills Site	4	(Pathfinder) Lucky Mc Site	35	(Petrotomics) Shirley Basin Site 1	34
(Exxon) Highlands Site	0	(Pathfinder) Shirley Basin Site 2	35	(Union Pacific) Bear Creek Site	34
Hoe Creek Underground Coal Gasification Site	0	(Petrotomics) Shirley Basin Site 1	35	(WNI) Split Rock Site	34
(Kennecott) Sweetwater Site	0	(UMETCO) Gas Hills Site	35	(UMETCO) Gas Hills Site	34
Naval Petroleum Reserve No. 3 Landfill/Landfarm	0	(Union Pacific) Bear Creek Site	35	(Exxon) Highlands Site	26
(Pathfinder) Lucky Mc Site	0	(WNI) Split Rock Site	35	(Kennecott) Sweetwater Site	26

**Table E-1. Long-Term Stewardship Costs by State for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
(Pathfinder) Shirley Basin Site 2	0	(Exxon) Highlands Site	26	(ANC) Gas Hills Site	20
(Petrochemicals) Shirley Basin Site 1	0	Spook Site	24	Spook Site	10
Riverton Site	0	(ANC) Gas Hills Site	21	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3
Rock Springs Oil Shale Retort Site	0	Riverton Site	6	Riverton Site	1
(UMETCO) Gas Hills Site	0	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3	Hoe Creek Underground Coal Gasification Site	0
(WNI) Split Rock Site	0	(Kennecott) Sweetwater Site	0	Rock Springs Oil Shale Retort Site	0

\* Costs are in thousands of constant 2000 dollars.

\*\* Because post-2010 costs were reported in five-year periods, costs for 2050 were calculated by averaging the costs for years 2046-2050.

\*\*\*Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.

**Table E-2. Long-Term Stewardship Costs by Site for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Savannah River Site***	\$35,001	Savannah River Site***	\$25,779	Hanford Site	\$36,716
Portsmouth Gaseous Diffusion Plant	\$6,764	Oak Ridge Reservation	\$7,508	Oak Ridge Reservation	\$15,987
Paducah Gaseous Diffusion Plant	\$6,599	Portsmouth Gaseous Diffusion Plant	\$6,041	Waste Isolation Pilot Plant	\$10,556
Oak Ridge Reservation	\$6,394	Paducah Gaseous Diffusion Plant	\$4,757	Paducah Gaseous Diffusion Plant	\$8,716
Fort St. Vrain	\$3,000	Idaho National Engineering and Environmental Laboratory	\$4,200	Rocky Flats Environmental Technology Site	\$5,959
Nevada Test Site	\$2,023	Fort St. Vrain	\$3,000	Savannah River Site***	\$5,607
Canonsburg Site	\$577	Nevada Test Site	\$2,155	Nevada Test Site	\$2,934
Cheney Disposal Cell	\$576	Kansas City Plant	\$1,504	Idaho National Engineering and Environmental Laboratory	\$2,400
Princeton Plasma Physics Laboratory	\$273	Pantex Plant	\$1,374	Fernald Environmental Management Project	\$1,928
Lakeview Mill	\$260	Lawrence Berkeley National Laboratory	\$1,179	Pantex Plant	\$1,513
Salmon Site	\$180	Weldon Spring Site	\$1,006	Portsmouth Gaseous Diffusion Plant	\$1,395
Palos Forest (Site A/Plot M) Preserve	\$170	Sandia National Laboratories - NM	\$1,000	Kansas City Plant	\$1,269
Fermi National Accelerator Laboratory	\$150	Monticello Mill Site and Vicinity Properties	\$510	Weldon Spring Site	\$1,006
Lovelace Respiratory Research Institute	\$140	Stanford Linear Accelerator	\$500	Sandia National Laboratories - NM	\$920
Mexican Hat	\$118	Cheney Disposal Cell	\$439	Los Alamos National Laboratory	\$700
Lakeview Site	\$116	Argonne National Laboratory East	\$413	Monticello Mill Site and Vicinity Properties	\$520
Bodo Canyon Cell	\$107	Rock Springs Oil Shale Retort Site	\$334	(Cotter) Cañon City Site	\$171
Salt Lake City Mill	\$84	Princeton Plasma Physics Laboratory	\$281	(Dawn) Ford Site	\$171
Sandia National Laboratories - CA	\$84	Hoe Creek Underground Coal Gasification Site	\$273	Palos Forest (Site A/Plot M) Preserve	\$170
Falls City Site	\$82	Palos Forest (Site A/Plot M) Preserve	\$170	Lawrence Livermore National Laboratory - Livermore Site	\$140
Burro Canyon Disposal Cell	\$64	Fermi National Accelerator Laboratory	\$150	Grand Junction Mill 2	\$128
Burrell Site	\$57	Lovelace Respiratory Research Institute	\$140	Stanford Linear Accelerator	\$100

**Table E-2. Long-Term Stewardship Costs by Site for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Shiprock Site	\$57	Grand Junction Mill 2	\$121	Sandia National Laboratories - CA	\$84
(WNI) Sherwood Site	\$53	Bodo Canyon Cell	\$119	Gasbuggy Site	\$59
Grand Junction Mill 1	\$50	Falls City Site	\$118	Shiprock Site	\$59
Hanford Site	\$47	Mexican Hat Site	\$113	Project Shoal	\$55
Hallam Nuclear Power Facility	\$44	Shiprock Site	\$103	Salmon Site	\$55
Bluewater Site	\$41	Sandia National Laboratories - CA	\$84	Central Nevada Test Area	\$54
Green River Site	\$41	Lakeview Site	\$83	Gnome-Coach	\$54
Lowman Site	\$40	Green River Site	\$75	Rio Blanco	\$54
Gunnison Disposal Cell	\$37	Burro Canyon Disposal Cell	\$63	Rulison	\$54
Tuba City Site	\$33	Tuba City Site	\$63	(Conoco) Conquista Site	\$51
Gasbuggy Site	\$28	Canonsburg Site	\$62	(UMETCO) UraVan Site	\$51
Gnome-Coach	\$28	Hanford Site	\$62	Bodo Canyon Cell	\$50
Rio Blanco	\$27	Lowman Site	\$59	Miamisburg Environmental Management Project	\$50
Rulison	\$27	(Conoco) Conquista Site	\$52	Falls City Site	\$45
Center for Energy and Environmental Research	\$25	Burrell Site	\$40	Mexican Hat Site	\$45
Estes Gulch Disposal Cell	\$24	Central Nevada Test Area	\$40	Amchitka Island	\$43
Naturita Site	\$23	Gasbuggy Site	\$40	(UNC) Church Rock Site	\$43
Piqua Nuclear Power Facility	\$20	Gnome-Coach	\$40	Tuba City Site	\$35
(Union Pacific) Bear Creek Site	\$19	Gunnison Disposal Cell	\$40	(Chevron) Panna Maria Site	\$34
Central Nevada Test Area	\$17	Project Shoal	\$40	Lakeview Site	\$34
(SOHIO) LBAR Site	\$17	Rio Blanco	\$40	(Pathfinder) Lucky Mc Site	\$34
Parkersburg Site	\$16	Rulison	\$40	(Pathfinder) Shirley Basin Site 2	\$34
Project Shoal	\$16	Salmon Site	\$40	(Petrochemicals) Shirley Basin Site 1	\$34
(Exxon) Ray Point Site	\$15	Estes Gulch Disposal Cell	\$36	(Quivira) Ambrosia Lake Site 2	\$34
South Clive Disposal Cell	\$14	(Chevron) Panna Maria Site	\$35	(SOHIO) LBAR Site	\$34
Spook Site	\$13	(Pathfinder) Lucky Mc Site	\$35	(UMETCO) Gas Hills Site	\$34
Edgemont Site	\$11	(Pathfinder) Shirley Basin Site 2	\$35	(Union Pacific) Bear Creek Site	\$34
(Chevron) Panna Maria Site	\$5	(Petrochemicals) Shirley Basin Site 1	\$35	(WNI) Sherwood Site	\$34



**Table E-2. Long-Term Stewardship Costs by Site for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
(Conoco) Conquista Site	\$5	(SOHIO) LBAR Site	\$35	(WNI) Split Rock Site	\$34
Ambrosia Lake Site	\$4	(UMETCO) Gas Hills Site	\$35	Hallam Nuclear Power Facility	\$32
(ANC) Gas Hills Site	\$4	(Union Pacific) Bear Creek Site	\$35	Monument Valley Site	\$30
(HECLA) Durita Site	\$4	(WNI) Sherwood Site	\$35	Green River Site	\$28
(UMETCO) Maybell Site 2	\$4	(WNI) Split Rock Site	\$35	Burro Canyon Disposal Cell	\$26
Naval Oil Shale Reserves Site	\$3	Hallam Nuclear Power Facility	\$31	(EFN) White Mesa Site	\$26
Maybell Mill Site	\$2	South Clive Disposal Cell	\$28	(Exxon) Highlands Site	\$26
Bayo Canyon	\$1	(Exxon) Highlands Site	\$26	(Exxon) Ray Point Site	\$26
Amchitka Island	\$0	(Exxon) Ray Point Site	\$26	(Homestake) Grants Site	\$26
Argonne National Laboratory East	\$0	Maybell Mill Site	\$26	(Kennecott) Sweetwater Site	\$26
(Atlas) Moab Mill	\$0	(UMETCO) Maybell Site 2	\$26	Maybell Mill Site	\$26
Brookhaven National Laboratory	\$0	Center for Energy and Environmental Research	\$25	(Rio Algom) Lisbon Valley Site	\$26
(Cotter) Cañon City Site	\$0	Naturita Site	\$24	(UMETCO) Maybell Site 2	\$26
(Dawn) Ford Site	\$0	Spook Site	\$24	Canonsburg Site	\$25
Durango Mill	\$0	Ambrosia Lake Site	\$21	Center for Energy and Environmental Research	\$25
(EFN) White Mesa Site	\$0	(ANC) Gas Hills Site	\$21	Cheney Disposal Cell	\$24
(Exxon) Highlands Site	\$0	Piqua Nuclear Power Facility	\$18	Lowman Site	\$24
Fernald Environmental Management Project	\$0	(Atlas) Moab Mill	\$17	(Plateau) Shootaring Canyon Site	\$24
Grand Junction Mill 2	\$0	Parkersburg Site	\$15	Ambrosia Lake Site	\$20
Gunnison Mill	\$0	Bluewater Site	\$13	(ANC) Gas Hills Site	\$20
Hoe Creek Underground Coal Gasification Site	\$0	(HECLA) Durita Site	\$11	Parkersburg Site	\$18
(Homestake) Grants Site	\$0	Edgemont Site	\$7	(Atlas) Moab Mill	\$16
Idaho National Engineering and Environmental Laboratory	\$0	Riverton Site	\$6	Burrell Site	\$16
Kansas City Plant	\$0	Grand Junction Mill 1	\$4	Gunnison Disposal Cell	\$16
(Kennecott) Sweetwater Site	\$0	Naval Oil Shale Reserves Site	\$3	Estes Gulch Disposal Cell	\$14
Lawrence Berkeley National Laboratory	\$0	Naval Petroleum Reserve No.3 Landfill/Landfarm	\$3	Lawrence Livermore National Laboratory - Site 300	\$14

**Table E-2. Long-Term Stewardship Costs by Site for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Lawrence Livermore National Laboratory - Livermore Site	\$0	Bayo Canyon	\$1	Bluewater Site	\$13
Lawrence Livermore National Laboratory - Site 300	\$0	Amchitka Island	\$0	South Clive Disposal Cell	\$11
Los Alamos National Laboratory	\$0	Brookhaven National Laboratory	\$0	(HECLA) Durita Site	\$10
Miamisburg Environmental Management Project	\$0	(Cotter) Cañon City Site	\$0	Spook Site	\$10
Monticello Mill Site and Vicinity Properties	\$0	(Dawn) Ford Site	\$0	Naturita Site	\$9
Monument Valley Site	\$0	Durango Mill	\$0	Edgemont Site	\$7
Naturita Mill	\$0	(EFN) White Mesa Site	\$0	Grand Junction Mill 1	\$5
Naval Petroleum Reserve No. 3 Landfill/Landfarm	\$0	Fernald Environmental Management Project	\$0	Naval Oil Shale Reserves Site	\$4
Pantex Plant	\$0	Gunnison Mill	\$0	Naval Petroleum Reserve No. 3 Landfill/Landfarm	\$3
(Pathfinder) Lucky Mc Site	\$0	(Homestake) Grants Site	\$0	Lakeview Mill	\$2
(Pathfinder) Shirley Basin Site 2	\$0	(Kennecott) Sweetwater Site	\$0	Slick Rock (North Continent) Mill 1	\$2
(Petrotomics) Shirley Basin Site 1	\$0	Lakeview Mill	\$0	Bayo Canyon	\$1
Pinellas STAR Center	\$0	Lawrence Livermore National Laboratory- Livermore Site	\$0	Durango Mill	\$1
(Plateau) Shootaring Canyon Site	\$0	Lawrence Livermore National Laboratory - Site 300	\$0	Naturita Mill	\$1
(Quivira) Ambrosia Lake Site 2	\$0	Los Alamos National Laboratory	\$0	Rifle (New) Mill	\$1
Rifle (New) Mill	\$0	Miamisburg Environmental Management Project	\$0	Riverton Site	\$1
Rifle (Old) Mill	\$0	Monument Valley Site	\$0	Slick Rock (Union Carbide) Mill 2	\$1
(Rio Algom) Lisbon Valley Site	\$0	Naturita Mill	\$0	Argonne National Laboratory East	\$0
Riverton Site	\$0	Pinellas STAR Center	\$0	Brookhaven National Laboratory	\$0
Rock Springs Oil Shale Retort Site	\$0	(Plateau) Shootaring Canyon Site	\$0	Fermi National Accelerator Laboratory	\$0
Rocky Flats Environmental Technology Site	\$0	(Quivira) Ambrosia Lake Site 2	\$0	Fort St. Vrain	\$0
Sandia National Laboratories - NM	\$0	Rifle (New) Mill	\$0	Gunnison Mill	\$0

**Table E-2. Long-Term Stewardship Costs by Site for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Slick Rock (North Continent) Mill 1	\$0	Rifle (Old ) Mill	\$0	Hoe Creek Underground Coal Gasification Site	\$0
Slick Rock (Union Carbide) Mill 2	\$0	(Rio Algom) Lisbon Valley Site	\$0	Lawrence Berkeley National Laboratory	\$0
Stanford Linear Accelerator	\$0	Rocky Flats Environmental Technology Site	\$0	Lovelace Respiratory Research Institute	\$0
(UMETCO) Gas Hills Site	\$0	Salt Lake City Mill	\$0	Pinellas STAR Center	\$0
(UMETCO) Uravan Site	\$0	Slick Rock (North Continent) Mill 1	\$0	Piqua Nuclear Power Facility	\$0
(UNC) Church Rock Site	\$0	Slick Rock (Union Carbide) Mill 2	\$0	Princeton Plasma Physics Laboratory	\$0
Waste Isolation Pilot Plant	\$0	(UMETCO) Uravan Site	\$0	Rifle (Old) Mill	\$0
Weldon Spring Site	\$0	(UNC) Church Rock Site	\$0	Rock Springs Oil Shale Retort Site	\$0
(WNI) Split Rock Site	\$0	Waste Isolation Pilot Plant	\$0	Salt Lake City Mill	\$0

\* Costs are in thousands of constant 2000 dollars.

\*\* Because post-2010 costs were reported in five-year periods, costs for 2050 were calculated by averaging the costs for years 2046-2050.

\*\*\*Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.



**Table E-3. Long-Term Stewardship Costs by Operations/Program Office for Years  
2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
<b>Albuquerque Operations Office Sites</b>	<b>224</b>	<b>Albuquerque Operations Office Sites</b>	<b>4,102</b>	<b>Albuquerque Operations Office Sites</b>	<b>4,486</b>
Lovelace Respiratory Research Institute	140	Kansas City Plant	1,504	Pantex Plant	1,513
Sandia National Laboratories - CA	84	Pantex Plant	1,374	Kansas City Plant	1,269
Kansas City Plant	0	Sandia National Laboratories - NM	1,000	Sandia National Laboratories - NM	920
Los Alamos National Laboratory	0	Lovelace Respiratory Research Institute	140	Los Alamos National Laboratory	700
Pantex Plant	0	Sandia National Laboratories - CA	84	Sandia National Laboratories - CA	84
Sandia National Laboratories - NM	0	Los Alamos National Laboratory	0	Lovelace Respiratory Research Institute	0
<b>Carlsbad Office</b>	<b>0</b>	<b>Carlsbad Office</b>	<b>0</b>	<b>Carlsbad Office</b>	<b>10,556</b>
Waste Isolation Pilot Plant	0	Waste Isolation Pilot Plant	0	Waste Isolation Pilot Plant	10,556
<b>Chicago Operations Office</b>	<b>423</b>	<b>Chicago Operations Office</b>	<b>844</b>	<b>Chicago Operations Office</b>	<b>0</b>
Princeton Plasma Physics Laboratory	273	Argonne National Laboratory East	413	Argonne National Laboratory East	0
Fermi National Accelerator Laboratory	150	Princeton Plasma Physics Laboratory	281	Brookhaven National Laboratory	0
Argonne National Laboratory East	0	Fermi National Accelerator Laboratory	150	Fermi National Accelerator Laboratory	0
Brookhaven National Laboratory	0	Brookhaven National Laboratory	0	Princeton Plasma Physics Laboratory	0
<b>Fossil Energy</b>	<b>3</b>	<b>Fossil Energy</b>	<b>613</b>	<b>Fossil Energy</b>	<b>7</b>
Naval Oil Shale Reserves Site	3	Rock Springs Oil Shale Retort Site	334	Naval Oil Shale Reserves Site	4
Hoe Creek Underground Coal Gasification Site	0	Hoe Creek Underground Coal Gasification Site	273	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3
Naval Petroleum Reserve No. 3 Landfill/Landfarm	0	Naval Oil Shale Reserves Site	3	Hoe Creek Underground Coal Gasification Site	0
Rock Springs Oil Shale Retort Site	0	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3	Rock Springs Oil Shale Retort Site	0
<b>Grand Junction Office</b>	<b>2,806</b>	<b>Grand Junction Office</b>	<b>3,535</b>	<b>Grand Junction Office</b>	<b>3,534</b>
Canonsburg Site	577	Weldon Spring Site	1,006	Weldon Spring Site	1,006
Cheney Disposal Cell	575	Monticello Mill Site and Vicinity Properties	510	Monticello Mill Site and Vicinity Properties	520
Lakeview Mill	260	Cheney Disposal Cell	439	(Cotter) Cañon City Site	171
Palos Forest (Site A/Plot M) Preserve	170	Palos Forest (Site A/Plot M) Preserve	170	(Dawn) Ford Site	171

**Table E-3. Long-Term Stewardship Costs by Operations/Program Office for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Mexican Hat Site	118	Grand Junction Mill 2	121	Palos Forest (Site A/Plot M) Preserve	170
Lakeview Site	116	Bodo Canyon Cell	119	Grand Junction Mill 2	128
Bodo Canyon Cell	107	Falls City Site	118	Shiprock Site	59
Salt Lake City Mill	84	Mexican Hat Site	113	(Conoco) Conquista Site	51
Falls City Site	82	Shiprock Site	103	(UMETCO) Uravan Site	51
Burro Canyon Disposal Cell	64	Lakeview Site	83	Bodo Canyon Cell	50
Burrell Site	57	Green River Site	75	Falls City Site	45
Shiprock Site	57	Burro Canyon Disposal Cell	63	Mexican Hat Site	45
(WNI) Sherwood Site	53	Tuba City Site	63	(UNC) Church Rock Site	43
Grand Junction Mill 1	50	Canonsburg Site	62	Tuba City Site	35
Hallam Nuclear Power Facility	44	Lowman Site	59	(Chevron) Panna Maria Site	34
Bluewater Site	41	(Conoco) Conquista Site	52	Lakeview Site	34
Green River Site	41	Burrell Site	40	(Pathfinder) Lucky Mc Site	34
Lowman Site	40	Gunnison Disposal Cell	40	(Pathfinder) Shirley Basin Site 2	34
Gunnison Disposal Cell	37	Estes Gulch Disposal Cell	36	(Petrochemicals) Shirley Basin Site 1	34
Tuba City Site	33	(Chevron) Panna Maria Site	35	(Quivira) Ambrosia Lake Site 2	34
Estes Gulch Disposal Cell	24	(Pathfinder) Lucky Mc Site	35	(SOHIO) LBAR Site	34
Naturita Site	23	(Pathfinder) Shirley Basin Site 2	35	(UMETCO) Gas Hills Site	34
Piqua Nuclear Power Facility	20	(Petrochemicals) Shirley Basin Site 1	35	(Union Pacific) Bear Creek Site	34
(Union Pacific) Bear Creek Site	19	(SOHIO) LBAR Site	35	(WNI) Sherwood Site	34
(SOHIO) LBAR Site	17	(UMETCO) Gas Hills Site	35	(WNI) Split Rock Site	34
Parkersburg Site	16	(Union Pacific) Bear Creek Site	35	Hallam Nuclear Power Facility	32
(Exxon) Ray Point Site	15	(WNI) Sherwood Site	35	Monument Valley Site	30
South Clive Disposal Cell	14	(WNI) Split Rock Site	35	Green River Site	28
Spook Site	13	Hallam Nuclear Power Facility	31	Burro Canyon Disposal Cell	26
Edgemont Site	11	South Clive Disposal Cell	28	(EFN) White Mesa Site	26
(Chevron) Panna Maria Site	5	(Exxon) Highlands Site	26	(Exxon) Highlands Site	26
(Conoco) Conquista Site	5	(Exxon) Ray Point Site	26	(Exxon) Ray Point Site	26

**Table E-3. Long-Term Stewardship Costs by Operations/Program Office for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Ambrosia Lake Site	4	Maybell Mill Site	26	(Homestake) Grants Site	26
(ANC) Gas Hills Site	4	(UMETCO) Maybell Site 2	26	(Kennecott) Sweetwater Site	26
(HECLA) Durita Site	4	Naturita Site	24	Maybell Mill Site	26
(UMETCO) Maybell Site 2	4	Spook Site	24	(Rio Algom) Lisbon Valley Site	26
Maybell Mill Site	2	Ambrosia Lake Site	21	(UMETCO) Maybell Site 2	26
(Atlas) Moab Mill	0	(ANC) Gas Hills Site	21	Canonsburg Site	25
(Cotter) Cañon City Site	0	Piqua Nuclear Power Facility	18	Cheney Disposal Cell	24
(Dawn) Ford Site	0	(Atlas) Moab Mill	17	Lowman Site	24
Durango Mill	0	Parkersburg Site	15	(Plateau) Shootaring Canyon Site	24
(EFN) White Mesa Site	0	Bluewater Site	13	Ambrosia Lake Site	20
(Exxon) Highlands Site	0	(HECLA) Durita Site	11	(ANC) Gas Hills Site	20
Grand Junction Mill 2	0	Edgemont Site	7	Parkersburg Site	18
Gunnison Mill	0	Riverton Site	6	(Atlas) Moab Mill	16
(Homestake) Grants Site	0	Grand Junction Mill 1	4	Burrell Site	16
(Kennecott) Sweetwater Site	0	(Cotter) Cañon City Site	0	Gunnison Disposal Cell	16
Monticello Mill Site and Vicinity Properties	0	(Dawn) Ford Site	0	Estes Gulch Disposal Cell	14
Monument Valley Site	0	Durango Mill	0	Bluewater Site	13
Naturita Mill	0	(EFN) White Mesa Site	0	South Clive Disposal Cell	11
(Pathfinder) Lucky Mc Site	0	Gunnison Mill	0	(HECLA) Durita Site	10
(Pathfinder) Shirley Basin Site 2	0	(Homestake) Grants Site	0	Spook Site	10
(Petrochemicals) Shirley Basin Site 1	0	(Kennecott) Sweetwater Site	0	Naturita Site	9
Pinellas STAR Center	0	Lakeview Mill	0	Edgemont Site	7
(Plateau) Shootaring Canyon Site	0	Monument Valley Site	0	Grand Junction Mill 1	5
(Quivira) Ambrosia Lake Site 2	0	Naturita Mill	0	Lakeview Mill	2
Rifle (New) Mill	0	Pinellas STAR Center	0	Slick Rock (North Continent) Mill 1	2
Rifle (Old) Mill	0	(Plateau) Shootaring Canyon Site	0	Durango Mill	1
(Rio Algom) Lisbon Valley Site	0	(Quivira) Ambrosia Lake Site 2	0	Naturita Mill	1

**Table E-3. Long-Term Stewardship Costs by Operations/Program Office for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Riverton Site	0	Rifle (New) Mill	0	Rifle (New) Mill	1
Slick Rock (North Continent) Mill 1	0	Rifle (Old) Mill	0	Riverton Site	1
Slick Rock (Union Carbide) Mill 2	0	(Rio Algom) Lisbon Valley Site	0	Slick Rock (Union Carbide) Mill 2	1
(UMETCO) Gas Hills Site	0	Salt Lake City Mill	0	Gunnison Mill	0
(UMETCO) Uravan Site	0	Slick Rock (North Continent) Mill 1	0	Pinellas STAR Center	0
(UNC) Church Rock Site	0	Slick Rock (Union Carbide) Mill 2	0	Piqua Nuclear Power Facility	0
Weldon Spring Site	0	(UMETCO) Uravan Site	0	Rifle (Old) Mill	0
(WNI) Split Rock Site	0	(UNC) Church Rock Site	0	Salt Lake City Mill	0
<b>Idaho Operations Office</b>	<b>3,000</b>	<b>Idaho Operations Office</b>	<b>7,200</b>	<b>Idaho Operations Office</b>	<b>2,400</b>
Fort St. Vrain	3,000	Idaho National Engineering and Environmental Laboratory	4,200	Idaho National Engineering and Environmental Laboratory	2,400
Idaho National Engineering and Environmental Laboratory	0	Fort St. Vrain	3,000	Fort St. Vrain	0
<b>Nevada Operations Office</b>	<b>2,346</b>	<b>Nevada Operations Office</b>	<b>2,435</b>	<b>Nevada Operations Office</b>	<b>3,362</b>
Nevada Test Site	2,023	Nevada Test Site	2,155	Nevada Test Site	2,934
Salmon Site	180	Central Nevada Test Area	40	Gasbuggy Site	59
Gasbuggy Site	28	Gasbuggy Site	40	Project Shoal	55
Gnome-Coach	28	Gnome-Coach	40	Salmon Site	55
Rio Blanco	27	Project Shoal	40	Central Nevada Test Area	54
Rulison	27	Rio Blanco	40	Gnome-Coach	54
Central Nevada Test Area	17	Rulison	40	Rio Blanco	54
Project Shoal	16	Salmon Site	40	Rulison	54
Amchitka Island	0	Amchitka Island	0	Amchitka Island	43
<b>Oak Ridge Operations Office</b>	<b>19,783</b>	<b>Oak Ridge Operations Office</b>	<b>18,332</b>	<b>Oak Ridge Operations Office</b>	<b>26,124</b>
Portsmouth Gaseous Diffusion Plant	6,764	Oak Ridge Reservation	7,508	Oak Ridge Reservation	15,987
Paducah Gaseous Diffusion Plant	6,599	Portsmouth Gaseous Diffusion Plant	6,041	Paducah Gaseous Diffusion Plant	8,716
Oak Ridge Reservation	6,394	Paducah Gaseous Diffusion Plant	4,757	Portsmouth Gaseous Diffusion Plant	1,395
Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25



**Table E-3. Long-Term Stewardship Costs by Operations/Program Office for Years 2000, 2006, and 2050**

<i>FY 2000</i>		<i>FY 2006</i>		<i>FY 2050**</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Bayo Canyon	1	Bayo Canyon	1	Bayo Canyon	1
<b>Oakland Operations Office</b>	<b>0</b>	<b>Oakland Operations Office</b>	<b>1,679</b>	<b>Oakland Operations Office</b>	<b>254</b>
Lawrence Berkeley National Laboratory	0	Lawrence Berkeley National Laboratory	1,179	Lawrence Livermore National Laboratory - Livermore Site	140
Lawrence Livermore National Laboratory - Livermore Site	0	Stanford Linear Accelerator	500	Stanford Linear Accelerator	100
Lawrence Livermore National Laboratory - Site 300	0	Lawrence Livermore National Laboratory - Livermore Site	0	Lawrence Livermore National Laboratory - Site 300	14
Stanford Linear Accelerator	0	Lawrence Livermore National Laboratory - Site 300	0	Lawrence Berkeley National Laboratory	0
<b>Ohio Field Office</b>	<b>0</b>	<b>Ohio Field Office</b>	<b>0</b>	<b>Ohio Field Office</b>	<b>1,978</b>
Fernald Environmental Management Project	0	Fernald Environmental Management Project	0	Fernald Environmental Management Project	1,928
Miamisburg Environmental Management Project	0	Miamisburg Environmental Management Project	0	Miamisburg Environmental Management Project	50
<b>Richland/Office of River Protection</b>	<b>47</b>	<b>Richland/Office of River Protection</b>	<b>62</b>	<b>Richland/Office of River Protection</b>	<b>36,716</b>
Hanford Site	47	Hanford Site	62	Hanford Site	36,716
<b>Rocky Flats Field Office</b>	<b>0</b>	<b>Rocky Flats Field Office</b>	<b>0</b>	<b>Rocky Flats Field Office</b>	<b>5,959</b>
Rocky Flats Environmental Technology Site	0	Rocky Flats Environmental Technology Site	0	Rocky Flats Environmental Technology Site	5,959
<b>Savannah River Operations Office</b>	<b>35,001</b>	<b>Savannah River Operations Office</b>	<b>25,779</b>	<b>Savannah River Operations Office</b>	<b>5,607</b>
Savannah River Site***	35,001	Savannah River Site***	25,779	Savannah River Site***	5,607

\* Costs are in thousands of constant 2000 dollars.

\*\* Because post-2010 costs were reported in five-year periods, costs for 2050 were calculated by averaging the costs for years 2046-2050.

\*\*\*Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.



## APPENDIX F: PROJECTED ANNUAL AVERAGE LONG-TERM STEWARDSHIP COSTS FOR SITES: 2000-2010, 2031-2040, AND 2061-2070

Appendix F provides average annual long-term stewardship costs for each site for 2000-2010, 2031-2040, and 2061-2070. The average only includes years where long-term stewardship costs estimates are reported. Because 10-year periods are used, regulatory scheduled activities (e.g., CERCLA five-year reviews, routine maintenance) can be incorporated along with years when fewer activities are anticipated, reducing some of the annual variability associated with single year “snapshots.” The annual average costs are more representative of the cost profile of the site, but may not completely capture longer-term activities (i.e, scheduled 25-year well maintenance or replacement). These tables are provided in Appendix F: Table F-1. Annual Average Long-Term Stewardship Costs by State, Table F-2. Annual Average Long-Term Stewardship Costs by Site , Table F-3. Annual Average Long-Term Stewardship Costs by Operations/Program Office.

**Table F-1. Annual Average Long-Term Stewardship Costs by State\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
<b>Alaska Sites</b>	<b>95</b>	<b>Alaska Sites</b>	<b>43</b>	<b>Alaska Sites</b>	<b>43</b>
Amchitka Island	95	Amchitka Island	43	Amchitka Island	43
<b>Arizona Sites</b>	<b>56</b>	<b>Arizona Sites</b>	<b>64</b>	<b>Arizona Sites</b>	<b>64</b>
Tuba City Site	56	Tuba City Site	34	Tuba City Site	34
Monument Valley Site	0	Monument Valley Site	30	Monument Valley Site	30
<b>California Sites</b>	<b>14,262</b>	<b>California Sites</b>	<b>1,403</b>	<b>California Sites</b>	<b>200</b>
Lawrence Livermore National Laboratory - Livermore Site	8,248	Lawrence Berkeley National Laboratory	525	Stanford Linear Accelerator	100
Lawrence Livermore National Laboratory - Site 300	4,247	Lawrence Livermore National Laboratory - Livermore Site	496	Sandia National Laboratories - CA	84
Lawrence Berkeley National Laboratory	1,183	Lawrence Livermore National Laboratory - Site 300	198	Lawrence Livermore National Laboratory - Livermore Site	13
Stanford Linear Accelerator	500	Stanford Linear Accelerator	100	Lawrence Livermore National Laboratory - Site 300	3
Sandia National Laboratories - CA	84	Sandia National Laboratories - CA	84	Lawrence Berkeley National Laboratory	0
<b>Colorado Sites</b>	<b>11,031</b>	<b>Colorado Sites</b>	<b>9,134</b>	<b>Colorado Sites</b>	<b>6,854</b>
Rocky Flats Environmental Technology Site	6,752	Rocky Flats Environmental Technology Site	6,024	Rocky Flats Environmental Technology Site	6,176
Fort St. Vrain	3,000	Fort St. Vrain	2,400	(Cotter) Cañon City Site	170
Cheney Disposal Cell	454	(Cotter) Cañon City Site	170	Grand Junction Mill 2	128
Rifle (New) Mill	152	Grand Junction Mill 2	128	Rio Blanco	54
Grand Junction Mill 2	122	Rulison	85	Rulison	54
Bodo Canyon Cell	118	Rio Blanco	55	(UMETCO) Uravan Site	51

**Table F-1. Annual Average Long-Term Stewardship Costs by State\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Rifle (Old) Mill	76	(UMETCO) Uravan Site	51	Bodo Canyon Cell	50
Burro Canyon Disposal Cell	59	Bodo Canyon Cell	50	Burro Canyon Disposal Cell	26
(UMETCO) Uravan Site	52	Burro Canyon Disposal Cell	26	Maybell Mill Site	26
Gunnison Disposal Cell	47	Maybell Mill Site	26	(UMETCO) Maybell Site 2	26
Rulison	45	(UMETCO) Maybell Site 2	26	Cheney Disposal Cell	24
Rio Blanco	39	Cheney Disposal Cell	24	Gunnison Disposal Cell	16
Estes Gulch Disposal Cell	32	Gunnison Disposal Cell	16	Estes Gulch Disposal Cell	14
Maybell Mill Site	25	Estes Gulch Disposal Cell	14	(HECLA) Durita Site	10
(UMETCO) Maybell Site 2	25	(HECLA) Durita Site	10	Naturita Site	9
Naturita Site	22	Naturita Site	9	Grand Junction Mill 1	5
Durango Mill	21	Grand Junction Mill 1	5	Naval Oil Shale Reserves Site	4
Gunnison Mill	14	Naval Oil Shale Reserves Site	4	Slick Rock (North Continent) Mill 1	4
Grand Junction Mill 1	13	Slick Rock (North Continent) Mill 1	4	Durango Mill	2
Slick Rock (North Continent) Mill 1	11	Durango Mill	2	Naturita Mill	2
(HECLA) Durita Site	10	Naturita Mill	2	Slick Rock (Union Carbide) Mill 2	2
Slick Rock (Union Carbide) Mill 2	6	Slick Rock (Union Carbide) Mill 2	2	Rifle (New) Mill	1
Naval Oil Shale Reserves Site	3	Rifle (New) Mill	1	Fort St. Vrain	0
Naturita Mill	2	Gunnison Mill	0	Gunnison Mill	0
(Cotter) Cañon City Site	0	Rifle (Old) Mill	0	Rifle (Old) Mill	0
<b>Florida Sites</b>	<b>0</b>	<b>Florida Sites</b>	<b>0</b>	<b>Florida Sites</b>	<b>0</b>
Pinellas STAR Center	0	Pinellas STAR Center	77	Pinellas STAR Center	0
<b>Idaho Sites</b>	<b>4,532</b>	<b>Idaho Sites</b>	<b>4,259</b>	<b>Idaho Sites</b>	<b>3,624</b>
Idaho National Engineering and Environmental Laboratory	4,479	Idaho National Engineering and Environmental Laboratory	3,000	Idaho National Engineering and Environmental Laboratory	3,600
Lowman Site	53	Lowman Site	24	Lowman Site	24
<b>Illinois Sites</b>	<b>615</b>	<b>Illinois Sites</b>	<b>535</b>	<b>Illinois Sites</b>	<b>170</b>
Argonne National Laboratory East	295	Argonne National Laboratory East	215	Palos Forest (Site A/Plot M) Preserve	170
Palos Forest (Site A/Plot M) Preserve	170	Palos Forest (Site A/Plot M) Preserve	170	Argonne National Laboratory East	0

Table F-1. Annual Average Long-Term Stewardship Costs by State\*

FY 2000-2010		FY 2031-2040		FY 2061-2070	
Site	Cost (in 000s)	Site	Cost (in 000s)	Site	Cost (in 000s)
Fermi National Accelerator Laboratory	150	Fermi National Accelerator Laboratory	150	Fermi National Accelerator Laboratory	0
<b>Kentucky Sites</b>	<b>5,881</b>	<b>Kentucky Sites</b>	<b>5,716</b>	<b>Kentucky Sites</b>	<b>9,560</b>
Paducah Gaseous Diffusion Plant	5,881	Paducah Gaseous Diffusion Plant	5,716	Paducah Gaseous Diffusion Plant	9,560
<b>Mississippi Sites</b>	<b>59</b>	<b>Mississippi Sites</b>	<b>54</b>	<b>Mississippi Sites</b>	<b>54</b>
Salmon Site	59	Salmon Site	54	Salmon Site	54
<b>Missouri Sites</b>	<b>2,285</b>	<b>Missouri Sites</b>	<b>2,308</b>	<b>Missouri Sites</b>	<b>2,308</b>
Kansas City Plant	1,279	Kansas City Plant	1,302	Kansas City Plant	1,302
Weldon Spring Site	1,006	Weldon Spring Site	1,006	Weldon Spring Site	1,006
<b>Nebraska Sites</b>	<b>40</b>	<b>Nebraska Sites</b>	<b>31</b>	<b>Nebraska Sites</b>	<b>32</b>
Hallam Nuclear Power Facility	40	Hallam Nuclear Power Facility	31	Hallam Nuclear Power Facility	32
<b>Nevada Sites</b>	<b>2,267</b>	<b>Nevada Sites</b>	<b>5,870</b>	<b>Nevada Sites</b>	<b>7,430</b>
Nevada Test Site	2,191	Nevada Test Site	5,643	Nevada Test Site	7,322
Central Nevada Test Area	38	Central Nevada Test Area	135	Central Nevada Test Area	54
Project Shoal	38	Project Shoal	92	Project Shoal	54
<b>New Jersey Sites</b>	<b>280</b>	<b>New Jersey Sites</b>	<b>0</b>	<b>New Jersey Sites</b>	<b>0</b>
Princeton Plasma Physics Laboratory	280	Princeton Plasma Physics Laboratory	0	Princeton Plasma Physics Laboratory	0
<b>New Mexico Sites</b>	<b>1,641</b>	<b>New Mexico Sites</b>	<b>1,963</b>	<b>New Mexico Sites</b>	<b>12,519</b>
Sandia National Laboratories - NM	922	Sandia National Laboratories - NM	1,010	Waste Isolation Pilot Plant	10,556
Los Alamos National Laboratory	332	Los Alamos National Laboratory	490	Sandia National Laboratories - NM	1,070
Lovelace Respiratory Research Institute	140	Gasbuggy Site	154	Los Alamos National Laboratory	310
Shiprock Site	91	Gnome-Coach	79	Gasbuggy Site	154
Gasbuggy Site	43	Shiprock Site	59	Gnome-Coach	79
Gnome-Coach	39	(UNC) Church Rock Site	43	Shiprock Site	59
(SOHIO) LBAR Site	34	(Quivira) Ambrosia Lake Site 2	34	(UNC) Church Rock Site	43
Ambrosia Lake Site	20	(SOHIO) LBAR Site	34	(Quivira) Ambrosia Lake Site 2	34
Bluewater Site	19	(Homestake) Grants Site	26	(SOHIO) LBAR Site	34
Bayo Canyon	1	Ambrosia Lake Site	20	(Homestake) Grants Site	26
(Homestake) Grants Site	0	Bluewater Site	13	Ambrosia Lake Site	20
(Quivira) Ambrosia Lake Site 2	0	Bayo Canyon	1	Bluewater Site	13

**Table F-1. Annual Average Long-Term Stewardship Costs by State\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
(UNC) Church Rock Site	0	Lovelace Respiratory Research Institute	0	Bayo Canyon	1
Waste Isolation Pilot Plant	0	Waste Isolation Pilot Plant	0	Lovelace Respiratory Research Institute	0
<b>New York Sites</b>	<b>4,150</b>	<b>New York Sites</b>	<b>711</b>	<b>New York Sites</b>	<b>0</b>
Brookhaven National Laboratory	4,150	Brookhaven National Laboratory	711	Brookhaven National Laboratory	0
<b>Ohio Sites</b>	<b>11,184</b>	<b>Ohio Sites</b>	<b>3,652</b>	<b>Ohio Sites</b>	<b>3,373</b>
Portsmouth Gaseous Diffusion Plant	6,067	Fernald Environmental Management Project	1,928	Fernald Environmental Management Project	1,928
Fernald Environmental Management Project	5,049	Portsmouth Gaseous Diffusion Plant	1,674	Portsmouth Gaseous Diffusion Plant	1,395
Miamisburg Environmental Management Project	50	Miamisburg Environmental Management Project	50	Miamisburg Environmental Management Project	50
Piqua Nuclear Power Facility	18	Piqua Nuclear Power Facility	0	Piqua Nuclear Power Facility	0
<b>Oregon Sites</b>	<b>126</b>	<b>Oregon Sites</b>	<b>36</b>	<b>Oregon Sites</b>	<b>36</b>
Lakeview Site	82	Lakeview Site	34	Lakeview Site	34
Lakeview Mill	44	Lakeview Mill	2	Lakeview Mill	2
<b>Pennsylvania</b>	<b>141</b>	<b>Pennsylvania</b>	<b>41</b>	<b>Pennsylvania</b>	<b>41</b>
Canonsburg Site	103	Canonsburg Site	25	Canonsburg Site	25
Burrell Site	38	Burrell Site	16	Burrell Site	16
<b>Puerto Rico Sites</b>	<b>25</b>	<b>Puerto Rico Sites</b>	<b>25</b>	<b>Puerto Rico Sites</b>	<b>25</b>
Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25
<b>South Carolina Sites</b>	<b>20,240</b>	<b>South Carolina Sites</b>	<b>3,139</b>	<b>South Carolina Sites</b>	<b>13,267</b>
Savannah River Site**	20,240	Savannah River Site**	3,139	Savannah River Site**	13,267
<b>South Dakota Sites</b>	<b>8</b>	<b>South Dakota Sites</b>	<b>7</b>	<b>South Dakota Sites</b>	<b>7</b>
Edgemont Site	8	Edgemont Site	7	Edgemont Site	7
<b>Tennessee Sites</b>	<b>7,633</b>	<b>Tennessee Sites</b>	<b>8,499</b>	<b>Tennessee Sites</b>	<b>8,562</b>
Oak Ridge Reservation	7,633	Oak Ridge Reservation	8,499	Oak Ridge Reservation	8,562
<b>Texas Sites</b>	<b>1,645</b>	<b>Texas Sites</b>	<b>2,070</b>	<b>Texas Sites</b>	<b>1,669</b>
Pantex Plant	1,437	Pantex Plant	1,912	Pantex Plant	990
Falls City Site	105	(Conoco) Conquista Site	51	(Conoco) Conquista Site	51
(Conoco) Conquista Site	44	Falls City Site	47	Falls City Site	47
(Chevron) Panna Maria Site	33	(Chevron) Panna Maria Site	34	(Chevron) Panna Maria Site	34
(Exxon) Ray Point Site	26	(Exxon) Ray Point Site	26	(Exxon) Ray Point Site	26
<b>Utah Sites</b>	<b>648</b>	<b>Utah Sites</b>	<b>696</b>	<b>Utah Sites</b>	<b>696</b>

Table F-1. Annual Average Long-Term Stewardship Costs by State\*

FY 2000-2010		FY 2031-2040		FY 2061-2070	
Site	Cost (in 000s)	Site	Cost (in 000s)	Site	Cost (in 000s)
Monticello Mill Site and Vicinity Properties	386	Monticello Mill Site and Vicinity Properties	520	Monticello Mill Site and Vicinity Properties	520
Mexican Hat Site	106	Mexican Hat Site	45	Mexican Hat Site	45
Green River Site	67	Green River Site	28	Green River Site	28
(Rio Algom) Lisbon Valley Site	26	(EFN) White Mesa Site	26	(EFN) White Mesa Site	26
South Clive Disposal Cell	24	(Rio Algom) Lisbon Valley Site	26	(Rio Algom) Lisbon Valley Site	26
Salt Lake City Mill	22	(Plateau) Shootaring Canyon Site	24	(Plateau) Shootaring Canyon Site	24
(Atlas) Moab Mill	17	(Atlas) Moab Mill	16	(Atlas) Moab Mill	16
(EFN) White Mesa Site	0	South Clive Disposal Cell	11	South Clive Disposal Cell	11
(Plateau) Shootaring Canyon Site	0	Salt Lake City Mill	0	Salt Lake City Mill	0
<b>Washington Sites</b>	<b>96</b>	<b>Washington Sites</b>	<b>949</b>	<b>Washington Sites</b>	<b>39,904</b>
Hanford Site	59	Hanford Site	745	Hanford Site	39,700
(WNI) Sherwood Site	37	(Dawn) Ford Site	170	(Dawn) Ford Site	170
(Dawn) Ford Site	0	(WNI) Sherwood Site	34	(WNI) Sherwood Site	34
<b>West Virginia Sites</b>	<b>17</b>	<b>West Virginia Sites</b>	<b>18</b>	<b>West Virginia Sites</b>	<b>18</b>
Parkersburg Site	17	Parkersburg Site	18	Parkersburg Site	18
<b>Wyoming Sites</b>	<b>891</b>	<b>Wyoming Sites</b>	<b>290</b>	<b>Wyoming Sites</b>	<b>290</b>
Rock Springs Oil Shale Retort Site	334	(Pathfinder) Lucky Mc Site	34	(Pathfinder) Lucky Mc Site	34
Hoe Creek Underground Coal Gasification Site	273	(Pathfinder) Shirley Basin Site 2	34	(Pathfinder) Shirley Basin Site 2	34
(Pathfinder) Lucky Mc Site	35	(Petrotomics) Shirley Basin Site 1	34	(Petrotomics) Shirley Basin Site 1	34
(Pathfinder) Shirley Basin Site 2	35	(UMETCO) Gas Hills Site	34	(UMETCO) Gas Hills Site	34
(Petrotomics) Shirley Basin Site 1	35	(Union Pacific) Bear Creek Site	34	(Union Pacific) Bear Creek Site	34
(UMETCO) Gas Hills Site	35	(WNI) Split Rock Site	34	(WNI) Split Rock Site	34
(WNI) Split Rock Site	35	(Exxon) Highlands Site	26	(Exxon) Highlands Site	26
(Union Pacific) Bear Creek Site	34	(Kennecott) Sweetwater Site	26	(Kennecott) Sweetwater Site	26
(Exxon) Highlands Site	26	(ANC) Gas Hills Site	20	(ANC) Gas Hills Site	20
Spook Site	21	Spook Site	10	Spook Site	10
(ANC) Gas Hills Site	20	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3
Riverton Site	5	Riverton Site	1	Riverton Site	1

**Table F-1. Annual Average Long-Term Stewardship Costs by State\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Naval Petroleum Reserve No. 3 Landfill/Landfarm	3	Hoe Creek Underground Coal Gasification Site	0	Hoe Creek Underground Coal Gasification Site	0
(Kennecott) Sweetwater Site	0	Rock Springs Oil Shale Retort Site	0	Rock Springs Oil Shale Retort Site	0

\* The average only includes years where long-term stewardship cost estimates are non-zero. Costs are in thousands of constant 2000 dollars.

\*\* Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.



**Table F-2. Annual Average Long-Term Stewardship Costs by Site\***  
**(listed in order of highest to lowest cost)**

<i>FY 2000 - 2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>
Savannah River Site**	\$20,240	Oak Ridge Reservation	\$8,499	Hanford Site	\$39,700
Lawrence Livermore National Laboratory - Livermore Site	\$8,248	Rocky Flats Environmental Technology Site	\$6,024	Savannah River Site**	\$13,267
Oak Ridge Reservation	\$7,633	Paducah Gaseous Diffusion Plant	\$5,716	Waste Isolation Pilot Plant	\$10,556
Rocky Flats Environmental Technology Site	\$6,752	Nevada Test Site	\$5,643	Paducah Gaseous Diffusion Plant	\$9,560
Portsmouth Gaseous Diffusion Plant	\$6,067	Savannah River Site**	\$3,139	Oak Ridge Reservation	\$8,562
Paducah Gaseous Diffusion Plant	\$5,881	Idaho National Engineering and Environmental Laboratory	\$3,000	Nevada Test Site	\$7,322
Fernald Environmental Management Project	\$5,049	Fort St. Vrain	\$2,400	Rocky Flats Environmental Technology Site	\$6,176
Idaho National Engineering and Environmental Laboratory	\$4,479	Fernald Environmental Management Project	\$1,928	Idaho National Engineering and Environmental Laboratory	\$3,600
Lawrence Livermore National Laboratory - Site 300	\$4,247	Pantex Plant	\$1,912	Fernald Environmental Management Project	\$1,928
Brookhaven National Laboratory	\$4,150	Portsmouth Gaseous Diffusion Plant	\$1,674	Portsmouth Gaseous Diffusion Plant	\$1,395
Fort St. Vrain	\$3,000	Kansas City Plant	\$1,302	Kansas City Plant	\$1,302
Nevada Test Site	\$2,191	Sandia National Laboratories - NM	\$1,010	Sandia National Laboratories - NM	\$1,070
Pantex Plant	\$1,437	Weldon Spring Site	\$1,006	Weldon Spring Site	\$1,006
Kansas City Plant	\$1,279	Hanford Site	\$745	Pantex Plant	\$990
Lawrence Berkeley National Laboratory	\$1,183	Brookhaven National Laboratory	\$711	Monticello Mill Site and Vicinity Properties	\$520
Weldon Spring Site	\$1,006	Lawrence Berkeley National Laboratory	\$525	Los Alamos National Laboratory	\$310
Sandia National Laboratories - NM	\$922	Monticello Mill Site and Vicinity Properties	\$520	(Cotter) Cañon City Site	\$170
Stanford Linear Accelerator	\$500	Lawrence Livermore National Laboratory - Livermore Site	\$496	(Dawn) Ford Site	\$170
Cheney Disposal Cell	\$454	Los Alamos National Laboratory	\$490	Palos Forest (Site A/Plot M) Preserve	\$170

**Table F-2. Annual Average Long-Term Stewardship Costs by Site\***  
(listed in order of highest to lowest cost)

<i>FY 2000 - 2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>
Monticello Mill Site and Vicinity Properties	\$386	Argonne National Laboratory East	\$251	Gasbuggy Site	\$154
Rock Springs Oil Shale Retort Site	\$334	Lawrence Livermore National Laboratory - Site 300	\$198	Grand Junction Mill 2	\$128
Los Alamos National Laboratory	\$332	(Cotter) Cañon City Site	\$170	Stanford Linear Accelerator	\$100
Argonne National Laboratory East	\$295	(Dawn) Ford Site	\$170	Sandia National Laboratories - CA	\$84
Princeton Plasma Physics Laboratory	\$280	Palos Forest (Site A/Plot M) Preserve	\$170	Gnome-Coach	\$79
Hoe Creek Underground Coal Gasification Site	\$273	Gasbuggy Site	\$154	Shiprock Site	\$59
Palos Forest (Site A/Plot M) Preserve	\$170	Central Nevada Test Area	\$135	Central Nevada Test Area	\$54
Rifle (New) Mill	\$152	Grand Junction Mill 2	\$128	Project Shoal	\$54
Fermi National Accelerator Laboratory	\$150	Stanford Linear Accelerator	\$100	Rio Blanco	\$54
Lovelace Respiratory Research Institute	\$140	Project Shoal	\$92	Rulison	\$54
Grand Junction Mill 2	\$122	Rulison	\$85	Salmon Site	\$54
Bodo Canyon Cell	\$118	Sandia National Laboratories - CA	\$84	(Conoco) Conquista Site	\$51
Mexican Hat Site	\$106	Gnome-Coach	\$79	(UMETCO) Uravan Site	\$51
Falls City Site	\$105	Pinellas STAR Center	\$77	Bodo Canyon Cell	\$50
Canonsburg Site	\$103	Shiprock Site	\$59	Miamisburg Environmental Management Project	\$50
Amchitka Island	\$95	Rio Blanco	\$55	Falls City Site	\$47
Shiprock Site	\$91	Salmon Site	\$54	Mexican Hat Site	\$45
Sandia National Laboratories - CA	\$84	(Conoco) Conquista Site	\$51	Amchitka Island	\$43
Lakeview Site	\$82	(UMETCO) Uravan Site	\$51	(UNC) Church Rock Site	\$43
Rifle (Old) Mill	\$76	Bodo Canyon Cell	\$50	(Chevron) Panna Maria Site	\$34
Green River Site	\$67	Miamisburg Environmental Management Project	\$50	Lakeview Site	\$34
Burro Canyon Disposal Cell	\$59	Falls City Site	\$47	(Pathfinder) Lucky MC Site	\$34

**Table F-2. Annual Average Long-Term Stewardship Costs by Site\***  
**(listed in order of highest to lowest cost)**

<i>FY 2000 - 2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>
Hanford Site	\$59	Mexican Hat Site	\$45	(Pathfinder) Shirley Basin Site 2	\$34
Salmon Site	\$59	Amchitka Island	\$43	(Petrochemicals) Shirley Basin Site 1	\$34
Tuba City Site	\$56	(UNC) Church Rock Site	\$43	Quivira Ambrosia Lake Site 2	\$34
Lowman Site	\$53	Hallam Nuclear Power Facility	\$37	(SOHIO) LBAR Site	\$34
(UMETCO) Uruan Site	\$52	(Chevron) Panna Maria Site	\$34	Tuba City Site	\$34
Miamisburg Environmental Management Project	\$50	Lakeview Site	\$34	(UMETCO) Gas Hills Site	\$34
Gunnison Disposal Cell	\$47	(Pathfinder) Lucky Mc Site	\$34	(Union Pacific) Bear Creek Site	\$34
Rulison	\$45	(Pathfinder) Shirley Basin Site 2	\$34	(WNI) Sherwood Site	\$34
(Conoco) Conquista Site	\$44	(Petrochemicals) Shirley Basin Site 1	\$34	(WNI) Split Rock Site	\$34
Lakeview Mill	\$44	(Quivira) Ambrosia Lake Site 2	\$34	Hallam Nuclear Power Facility	\$32
Gasbuggy Site	\$43	(SOHIO) LBAR Site	\$34	Monument Valley Site	\$30
Hallam Nuclear Power Facility	\$40	Tuba City Site	\$34	Green River Site	\$28
Gnome-Coach	\$39	(UMETCO) Gas Hills Site	\$34	Burro Canyon Disposal Cell	\$26
Rio Blanco	\$39	(Union Pacific) Bear Creek Site	\$34	(EFN) White Mesa Site	\$26
Burrell Site	\$38	(WNI) Sherwood Site	\$34	(Exxon) Highlands Site	\$26
Central Nevada Test Area	\$38	(WNI) Split Rock Site	\$34	(Exxon) Ray Point Site	\$26
Project Shoal	\$38	Monument Valley Site	\$30	(Homestake) Grants Site	\$26
(WNI) Sherwood Site	\$37	Green River Site	\$28	(Kennecott) Sweetwater Site	\$26
(Pathfinder) Lucky Mc Site	\$35	Burro Canyon Disposal Cell	\$26	Maybell Mill Site	\$26
(Pathfinder) Shirley Basin Site 2	\$35	(EFN) White Mesa Site	\$26	(Rio Algom) Lisbon Valley Site	\$26
(Petrochemicals) Shirley Basin Site 1	\$35	(Exxon) Highlands Site	\$26	(UMETCO) Maybell Site 2	\$26

**Table F-2. Annual Average Long-Term Stewardship Costs by Site\***  
**(listed in order of highest to lowest cost)**

<i>FY 2000 - 2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>
(UMETCO) Gas Hills Site	\$35	(Exxon) Ray Point Site	\$26	Center for Energy and Environmental Research	\$25
(WNI) Split Rock Site	\$35	(Homestake) Grants Site	\$26	Canonsburg Site	\$25
(SOHIO) LBAR Site	\$34	(Kennecott) Sweetwater Site	\$26	Cheney Disposal Cell	\$24
(Union Pacific) Bear Creek Site	\$34	Maybell Mill Site	\$26	Lowman Site	\$24
(Chevron) Panna Maria Site	\$33	(Rio Algom) Lisbon Valley Site	\$26	(Plateau) Shootaring Canyon Site	\$24
Estes Gulch Disposal Cell	\$32	(UMETCO) Maybell Site 2	\$26	Ambrosia Lake Site	\$20
(Exxon) Highlands Site	\$26	Canonsburg Site	\$25	(ANC) Gas Hills Site	\$20
(Exxon) Ray Point Site	\$26	Center for Energy and Environmental Research	\$25	Parkersburg Site	\$18
(Rio Algom) Lisbon Valley Site	\$26	Cheney Disposal Cell	\$24	(Atlas) Moab Mill	\$16
Center for Energy and Environmental Research	\$25	Lowman Site	\$24	Burrell Site	\$16
Maybell Mill Site	\$25	(Plateau) Shootaring Canyon Site	\$24	Gunnison Disposal Cell	\$16
(UMETCO) Maybell Site 2	\$25	Ambrosia Lake Site	\$20	Estes Gulch Disposal Cell	\$14
South Clive Disposal Cell	\$24	(ANC) Gas Hills Site	\$20	Bluewater Site	\$13
Naturita Site	\$22	Parkersburg Site	\$18	Lawrence Livermore National Laboratory - Livermore Site	\$13
Salt Lake City Mill	\$22	(Atlas) Moab Mill	\$16	South Clive Disposal Cell	\$11
Durango Mill	\$21	Burrell Site	\$16	(HECLA) Durita Site	\$10
Spook Site	\$21	Gunnison Disposal Cell	\$16	Spook Site	\$10
Ambrosia Lake Site	\$20	Estes Gulch Disposal Cell	\$14	Naturita Site	\$9
(ANC) Gas Hills Site	\$20	Bluewater Site	\$13	Edgemont Site	\$7
Bluewater Site	\$18	South Clive Disposal Cell	\$11	Grand Junction Mill 1	\$5
Piqua Nuclear Power Facility	\$18	(HECLA) Durita Site	\$10	Naval Oil Shale Reserves Site	\$4
(Atlas) Moab Mill	\$17	Spook Site	\$10	Slick Rock (North Continent) Mill 1	\$4

**Table F-2. Annual Average Long-Term Stewardship Costs by Site\***  
**(listed in order of highest to lowest cost)**

<i>FY 2000 - 2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>
Parkersburg Site	\$17	Naturita Site	\$9	Lawrence Livermore National Laboratory - Site 300	\$3
Gunnison Mill	\$14	Edgemont Site	\$7	Naval Petroleum Reserve No. 3 Landfill/Landfarm	\$3
Grand Junction Mill 1	\$13	Grand Junction Mill 1	\$5	Durango Mill	\$2
Slick Rock (North Continent) Mill 1	\$11	Naval Oil Shale Reserves Site	\$4	Lakeview Mill	\$2
(HECLA) Durita Site	\$10	Slick Rock (North Continent) Mill 1	\$4	Naturita Mill	\$2
Edgemont Site	\$8	Naval Petroleum Reserve No. 3 Landfill/Landfarm	\$3	Slick Rock (Union Carbide) Mill 2	\$2
Slick Rock (Union Carbide) Mill 2	\$6	Durango Mill	\$2	Bayo Canyon	\$1
Riverton Site	\$5	Lakeview Mill	\$2	Rifle (New) Mill	\$1
Naval Oil Shale Reserves Site	\$3	Naturita Mill	\$2	Riverton Site	\$1
Naval Petroleum Reserve No. 3 Landfill/Landfarm	\$3	Slick Rock (Union Carbide) Mill 2	\$2	Argonne National Laboratory East	\$0
Bayo Canyon	\$1	Bayo Canyon	\$1	Brookhaven National Laboratory	\$0
(Cotter) Cañon City Site	\$0	Rifle (New) Mill	\$1	Fermi National Accelerator Laboratory	\$0
(Dawn) Ford Site	\$0	Riverton Site	\$1	Fort St. Vrain	\$0
(EFN) White Mesa Site	\$0	Fermi National Accelerator Laboratory	\$0	Gunnison Mill	\$0
(Homestake) Grants Site	\$0	Gunnison Mill	\$0	Hoe Creek Underground Coal Gasification Site	\$0
(Kennecott) Sweetwater Site	\$0	Hoe Creek Underground Coal Gasification Site	\$0	Lawrence Berkeley National Laboratory	\$0
Monument Valley Site	\$0	Lovelace Respiratory Research Institute	\$0	Lovelace Respiratory Research Institute	\$0
Naturita Mill	\$0	Piqua Nuclear Power Facility	\$0	Pinellas STAR Center	\$0
Pinellas STAR Center	\$0	Princeton Plasma Physics Laboratory	\$0	Piqua Nuclear Power Facility	\$0
(Plateau) Shootaring Canyon Site	\$0	Rifle (Old) Mill	\$0	Princeton Plasma Physics Laboratory	\$0

**Table F-2. Annual Average Long-Term Stewardship Costs by Site\***  
(listed in order of highest to lowest cost)

<i>FY 2000 - 2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>	<i>Site</i>	<i>Average Annual Cost (in 000s)</i>
(Quivira) Ambrosia Lake Site 2	\$0	Rock Springs Oil Shale Retort Site	\$0	Rifle (Old) Mill	\$0
(UNC) Church Rock Site	\$0	Salt Lake City Mill	\$0	Rock Springs Oil Shale Retort Site	\$0
Waste Isolation Pilot Plant	\$0	Waste Isolation Pilot Plant	\$0	Salt Lake City Mill	\$0

\* The average only includes years where long-term stewardship cost estimates are non-zero. Costs are in thousands of constant 2000 dollars.

\*\* Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.

**Table F-3. Annual Average Long-Term Stewardship Costs by Operations/Program Office\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
<b>Albuquerque Operations Office Sites</b>	<b>4,194</b>	<b>Albuquerque Operations Office Sites</b>	<b>4,798</b>	<b>Albuquerque Operations Office Sites</b>	<b>4,096</b>
Pantex Plant	1,437	Pantex Plant	1,912	Kansas City Plant	1,302
Kansas City Plant	1,279	Kansas City Plant	1,302	Sandia National Laboratories - NM	1,070
Sandia National Laboratories - NM	922	Sandia National Laboratories - NM	1,010	Pantex Plant	990
Los Alamos National Laboratory	332	Los Alamos National Laboratory	490	Los Alamos National Laboratory	310
Lovelace Respiratory Research Institute	140	Sandia National Laboratories - CA	84	Sandia National Laboratories - CA	84
Sandia National Laboratories - CA	84	Lovelace Respiratory Research Institute	0	Lovelace Respiratory Research Institute	0
<b>Carlsbad Office</b>	<b>0</b>	<b>Carlsbad Office</b>	<b>0</b>	<b>Carlsbad Office</b>	<b>10,556</b>
Waste Isolation Pilot Plant	0	Waste Isolation Pilot Plant	0	Waste Isolation Pilot Plant	10,556
<b>Chicago Operations Office</b>	<b>4,875</b>	<b>Chicago Operations Office</b>	<b>215</b>	<b>Chicago Operations Office</b>	<b>0</b>
Brookhaven National Laboratory	4,150	Princeton Plasma Physics Laboratory	0	Argonne National Laboratory East	0
Argonne National Laboratory East	295	Argonne National Laboratory East	215	Brookhaven National Laboratory	0
Princeton Plasma Physics Laboratory	280	Fermi National Accelerator Laboratory	0	Fermi National Accelerator Laboratory	0
Fermi National Accelerator Laboratory	150	Brookhaven National Laboratory	0	Princeton Plasma Physics Laboratory	0
<b>Fossil Energy</b>	<b>3</b>	<b>Fossil Energy</b>	<b>7</b>	<b>Fossil Energy</b>	<b>7</b>
Rock Springs Oil Shale Retort Site	334	Naval Oil Shale Reserves Site	4	Naval Oil Shale Reserves Site	4
Hoe Creek Underground Coal Gasification Site	273	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3	Naval Petroleum Reserve No. 3 Landfill/Landfarm	3
Naval Oil Shale Reserves Site	3	Hoe Creek Underground Coal Gasification Site	0	Hoe Creek Underground Coal Gasification Site	0
Naval Petroleum Reserve No. 3 Landfill/Landfarm	3	Rock Springs Oil Shale Retort Site	0	Rock Springs Oil Shale Retort Site	0
<b>Grand Junction Office</b>	<b>4,137</b>	<b>Grand Junction Office</b>	<b>3,595</b>	<b>Grand Junction Office</b>	<b>3,538</b>
Weldon Spring Site	1,006	Weldon Spring Site	1,006	Weldon Spring Site	1,006
Cheney Disposal Cell	454	Monticello Mill Site and Vicinity Properties	520	Monticello Mill Site and Vicinity Properties	520
Monticello Mill Site and Vicinity Properties	386	(Cotter) Cañon City Site	170	(Cotter) Cañon City Site	170
Palos Forest (Site A/Plot M) Preserve	170	(Dawn) Ford Site	170	(Dawn) Ford Site	170

**Table F-3. Annual Average Long-Term Stewardship Costs by Operations/Program Office\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Rifle (New) Mill	152	Palos Forest (Site A/Plot M) Preserve	170	Palos Forest (Site A/Plot M) Preserve	170
Grand Junction Mill 2	122	Grand Junction Mill 2	128	Grand Junction Mill 2	128
Bodo Canyon Cell	118	Pinellas STAR Center	77	Shiprock Site	59
Mexican Hat Site	106	Shiprock Site	59	(Conoco) Conquista Site	51
Falls City Site	105	(Conoco) Conquista Site	51	(UMETCO) Uravan Site	51
Canonsburg Site	103	(UMETCO) Uravan Site	51	Bodo Canyon Cell	50
Shiprock Site	91	Bodo Canyon Cell	50	Falls City Site	47
Lakeview Site	82	Falls City Site	47	Mexican Hat Site	45
Rifle (Old) Mill	76	Mexican Hat Site	45	(UNC) Church Rock Site	43
Green River Site	67	(UNC) Church Rock Site	43	(Chevron) Panna Maria Site	34
Burro Canyon Disposal Cell	59	Hallam Nuclear Power Facility	37	Lakeview Site	34
Tuba City Site	56	(Chevron) Panna Maria Site	34	(Pathfinder) Lucky Mc Site	34
Lowman Site	53	Lakeview Site	34	(Pathfinder) Shirley Basin Site 2	34
(UMETCO) Uravan Site	52	(Pathfinder) Lucky Mc Site	34	(Petrotomics) Shirley Basin Site 1	34
Gunnison Disposal Cell	47	(Pathfinder) Shirley Basin Site 2	34	(Quivira) Ambrosia Lake Site 2	34
(Conoco) Conquista Site	44	(Petrotomics) Shirley Basin Site 1	34	(SOHIO) LBAR Site	34
Lakeview Mill	44	(Quivira) Ambrosia Lake Site 2	34	Tuba City Site	34
Hallam Nuclear Power Facility	40	(SOHIO) LBAR Site	34	(UMETCO) Gas Hills Site	34
Burrell Site	38	Tuba City Site	34	(Union Pacific) Bear Creek Site	34
(WNI) Sherwood Site	37	(UMETCO) Gas Hills Site	34	(WNI) Sherwood Site	34
(Pathfinder) Lucky Mc Site	35	(Union Pacific) Bear Creek Site	34	(WNI) Split Rock Site	34
(Pathfinder) Shirley Basin Site 2	35	(WNI) Sherwood Site	34	Hallam Nuclear Power Facility	32
(Petrotomics) Shirley Basin Site 1	35	(WNI) Split Rock Site	34	Monument Valley Site	30
(UMETCO) Gas Hills Site	35	Monument Valley Site	30	Green River Site	28
(WNI) Split Rock Site	35	Green River Site	28	Burro Canyon Disposal Cell	26
(SOHIO) LBAR Site	34	Burro Canyon Disposal Cell	26	(EFN) White Mesa Site	26
(Union Pacific) Bear Creek Site	34	(EFN) White Mesa Site	26	(Exxon) Highlands Site	26



**Table F-3. Annual Average Long-Term Stewardship Costs by Operations/Program Office\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
(Chevron) Panna Maria Site	33	(Exxon) Highlands Site	26	(Exxon) Ray Point Site	26
Estes Gulch Disposal Cell	32	(Exxon) Ray Point Site	26	(Homestake) Grants Site	26
(Exxon) Highlands Site	26	(Homestake) Grants Site	26	(Kennecott) Sweetwater Site	26
(Exxon) Ray Point Site	26	(Kennecott) Sweetwater Site	26	Maybell Mill Site	26
(Rio Algom) Lisbon Valley Site	26	Maybell Mill Site	26	(Rio Algom) Lisbon Valley Site	26
Maybell Mill Site	25	(Rio Algom) Lisbon Valley Site	26	(UMETCO) Maybell Site 2	26
(UMETCO) Maybell Site 2	25	(UMETCO) Maybell Site 2	26	Canonsburg Site	25
South Clive Disposal Cell	24	Canonsburg Site	25	Cheney Disposal Cell	24
Naturita Site	22	Cheney Disposal Cell	24	Lowman Site	24
Salt Lake City Mill	22	Lowman Site	24	(Plateau) Shootaring Canyon Site	24
Durango Mill	21	(Plateau) Shootaring Canyon Site	24	Ambrosia Lake Site	20
Spook Site	21	Ambrosia Lake Site	20	(ANC) Gas Hills Site	20
Ambrosia Lake Site	20	(ANC) Gas Hills Site	20	Parkersburg Site	18
(ANC) Gas Hills Site	20	Parkersburg Site	18	(Atlas) Moab Mill	16
Bluewater Site	18	(Atlas) Moab Mill	16	Burrell Site	16
Piqua Nuclear Power Facility	18	Burrell Site	16	Gunnison Disposal Cell	16
(Atlas) Moab Mill	17	Gunnison Disposal Cell	16	Estes Gulch Disposal Cell	14
Parkersburg Site	17	Estes Gulch Disposal Cell	14	Bluewater Site	13
Gunnison Mill	14	Bluewater Site	13	South Clive Disposal Cell	11
Grand Junction Mill 1	13	South Clive Disposal Cell	11	(HECLA) Durita Site	10
Slick Rock (North Continent) Mill 1	11	(HECLA) Durita Site	10	Spook Site	10
(HECLA) Durita Site	10	Spook Site	10	Naturita Site	9
Edgemont Site	8	Naturita Site	9	Edgemont Site	7
Slick Rock (Union Carbide) Mill 2	6	Edgemont Site	7	Grand Junction Mill 1	5
Riverton Site	5	Grand Junction Mill 1	5	Slick Rock (North Continent) Mill 1	4
(Cotter) Cañon City Site	0	Slick Rock (North Continent) Mill 1	4	Durango Mill	2
(Dawn) Ford Site	0	Durango Mill	2	Lakeview Mill	2
(EFN) White Mesa Site	0	Lakeview Mill	2	Naturita Mill	2

**Table F-3. Annual Average Long-Term Stewardship Costs by Operations/Program Office\***

<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
(Homestake) Grants Site	0	Naturita Mill	2	Slick Rock (Union Carbide) Mill 2	2
(Kennecott) Sweetwater Site	0	Slick Rock (Union Carbide) Mill 2	2	Rifle (New) Mill	1
Monument Valley Site	0	Rifle (New) Mill	1	Riverton Site	1
Naturita Mill	0	Riverton Site	1	Gunnison Mill	0
Pinellas STAR Center	0	Gunnison Mill	0	Pinellas STAR Center	0
(Plateau) Shootaring Canyon Site	0	Piqua Nuclear Power Facility	0	Piqua Nuclear Power Facility	0
(Quivira) Ambrosia Lake Site 2	0	Rifle (Old) Mill	0	Rifle (Old) Mill	0
(UNC) Church Rock Site	0	Salt Lake City Mill	0	Salt Lake City Mill	0
<b>Idaho Operations Office</b>	<b>7,479</b>	<b>Idaho Operations Office</b>	<b>5,400</b>	<b>Idaho Operations Office</b>	<b>3,600</b>
Idaho National Engineering and Environmental Laboratory	4,479	Idaho National Engineering and Environmental Laboratory	3,000	Idaho National Engineering and Environmental Laboratory	3,600
Fort St. Vrain	3,000	Fort St. Vrain	2,400	Fort St. Vrain	0
<b>Nevada Operations Office</b>	<b>2,587</b>	<b>Nevada Operations Office</b>	<b>6,340</b>	<b>Nevada Operations Office</b>	<b>7,868</b>
Nevada Test Site	2,191	Nevada Test Site	5,643	Nevada Test Site	7,322
Amchitka Island	95	Gasbuggy Site	154	Gasbuggy Site	154
Salmon Site	59	Central Nevada Test Area	135	Gnome-Coach	79
Rulison	45	Project Shoal	92	Central Nevada Test Area	54
Gasbuggy Site	43	Rulison	85	Project Shoal	54
Gnome-Coach	39	Gnome-Coach	79	Rio Blanco	54
Rio Blanco	39	Rio Blanco	55	Rulison	54
Central Nevada Test Area	38	Amchitka Island	43	Salmon Site	54
Project Shoal	38	Salmon Site	40	Amchitka Island	43
<b>Oak Ridge Operations Office</b>	<b>19,607</b>	<b>Oak Ridge Operations Office</b>	<b>15,915</b>	<b>Oak Ridge Operations Office</b>	<b>19,543</b>
Oak Ridge Reservation	7,633	Oak Ridge Reservation	8,499	Paducah Gaseous Diffusion Plant	9,560
Portsmouth Gaseous Diffusion Plant	6,067	Paducah Gaseous Diffusion Plant	5,716	Oak Ridge Reservation	8,562
Paducah Gaseous Diffusion Plant	5,881	Portsmouth Gaseous Diffusion Plant	1,674	Portsmouth Gaseous Diffusion Plant	1,395
Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25	Center for Energy and Environmental Research	25
Bayo Canyon	1	Bayo Canyon	1	Bayo Canyon	1
<b>Oakland Operations Office</b>	<b>14,178</b>	<b>Oakland Operations Office</b>	<b>1,319</b>	<b>Oakland Operations Office</b>	<b>116</b>

**Table F-3. Annual Average Long-Term Stewardship Costs by Operations/Program Office\***

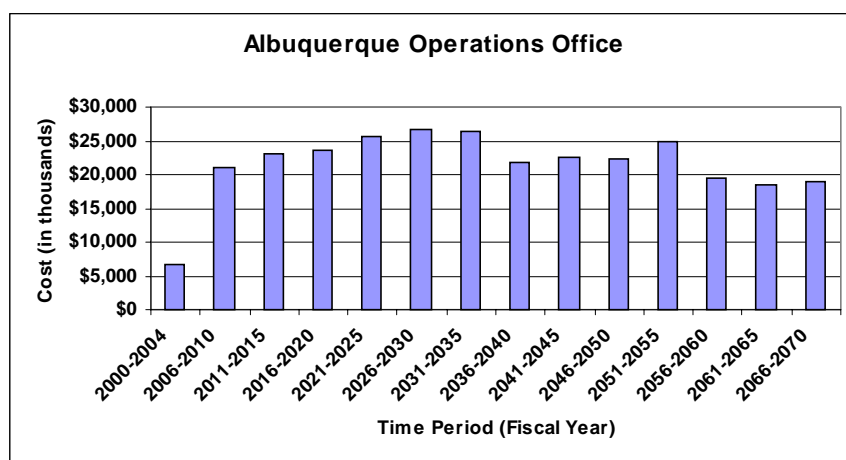
<i>FY 2000-2010</i>		<i>FY 2031-2040</i>		<i>FY 2061-2070</i>	
<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>	<i>Site</i>	<i>Cost (in 000s)</i>
Lawrence Livermore National Laboratory - Livermore Site	8,248	Lawrence Berkeley National Laboratory	1,313	Lawrence Livermore National Laboratory - Livermore Site	150
Lawrence Livermore National Laboratory - Site 300	4,247	Lawrence Livermore National Laboratory - Livermore Site	496	Stanford Linear Accelerator	100
Lawrence Berkeley National Laboratory	1,183	Lawrence Livermore National Laboratory - Site 300	198	Lawrence Livermore National Laboratory - Site 300	22
Stanford Linear Accelerator	500	Stanford Linear Accelerator	100	Lawrence Berkeley National Laboratory	0
<b>Ohio Field Office</b>	<b>5,099</b>	<b>Ohio Field Office</b>	<b>1,978</b>	<b>Ohio Field Office</b>	<b>1,978</b>
Fernald Environmental Management Project	5,049	Fernald Environmental Management Project	1,928	Fernald Environmental Management Project	1,928
Miamisburg Environmental Management Project	50	Miamisburg Environmental Management Project	50	Miamisburg Environmental Management Project	50
<b>Richland/Office of River Protection</b>	<b>59</b>	<b>Richland/Office of River Protection</b>	<b>745</b>	<b>Richland/Office of River Protection</b>	<b>39,700</b>
Hanford Site	59	Hanford Site	745	Hanford Site	39,700
<b>Rocky Flats Field Office</b>	<b>6,752</b>	<b>Rocky Flats Field Office</b>	<b>6,024</b>	<b>Rocky Flats Field Office</b>	<b>6,176</b>
Rocky Flats Environmental Technology Site	6,752	Rocky Flats Environmental Technology Site	6,024	Rocky Flats Environmental Technology Site	6,176
<b>Savannah River Operations Office</b>	<b>20,240</b>	<b>Savannah River Operations Office</b>	<b>3,139</b>	<b>Savannah River Operations Office</b>	<b>13,267</b>
Savannah River Site**	20,240	Savannah River Site**	3,139	Savannah River Site**	13,267

\* The average only includes years where long-term stewardship cost estimates are non-zero. Costs are in thousands of constant 2000 dollars.

\*\* Long-term stewardship cost estimates for the Savannah River Site in South Carolina do not include any activities scheduled to begin after 2006. At this time, these activities are not well known and cost estimates are not included in this Report. Therefore, post-2006 cost estimates provided in this section are likely to underestimate the Department's long-term cost obligations.



## APPENDIX G: CUMULATIVE COST BAR CHARTS DISPLAYED IN Five-Year INCREMENTS FOR EACH OPERATIONS OFFICE<sup>55</sup>



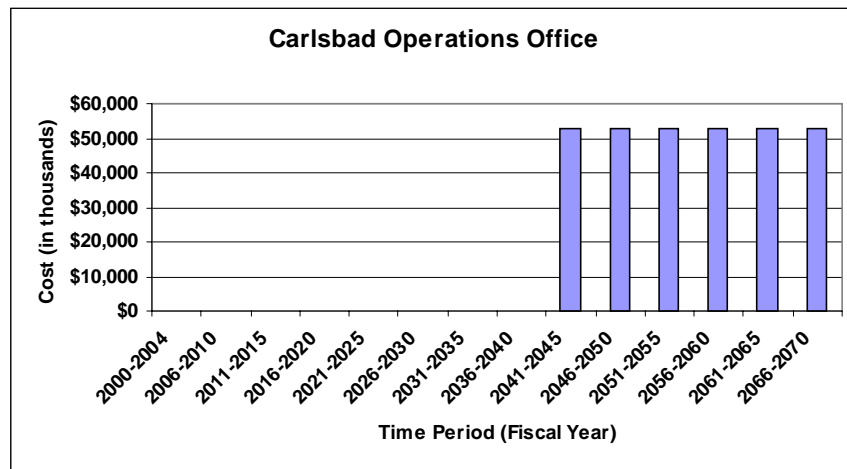
The Albuquerque Operations Office has six sites that will require long-term stewardship with sites (Lovelace Respiratory Research Institute and Sandia National Laboratories - CA) already conducting long-term stewardship activities by 2000. The long-term stewardship costs for the Albuquerque Operations Office increase sharply during the first five-year period (2000-2004), when two additional sites (the Pantex Plant and Sandia National Laboratories - NM) are scheduled to begin long-term stewardship activities. The final two sites (Los Alamos National Laboratory and the Kansas City Plant) are not scheduled to begin long-term stewardship activities until the second five-year period (2006-2010).

Long-term stewardship activities at the Pantex Plant are responsible for the largest costs for the Albuquerque Operations Office. Between 2000-2070 the Pantex Plant's long-term stewardship costs comprise approximately half of the total long-term stewardship costs. There is a small cost decrease between 2036 and 2040 precipitated solely by the long-term stewardship costs at the Pantex Plant. However, the site's costs are expected to increase until the end of 2055, at which time groundwater treatment and corrective action monitoring are expected to be completed (the time period for conducting groundwater compliance monitoring is not yet determined).

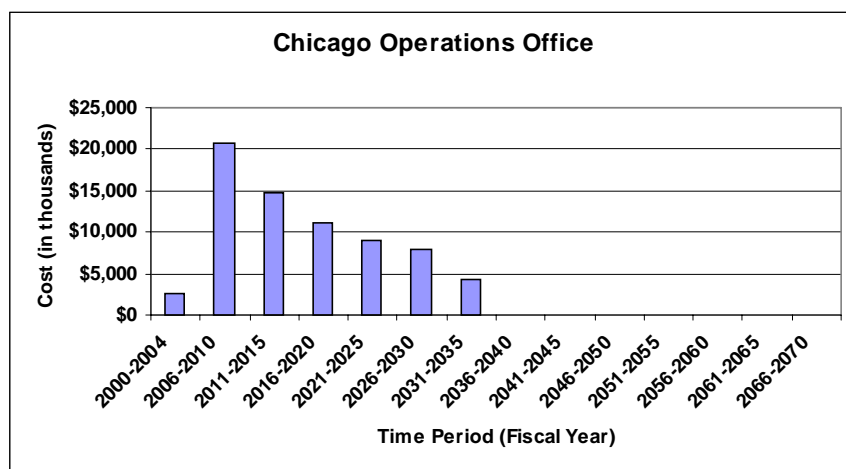
Only one site, the Lovelace Respiratory Research Institute (LRRI) is scheduled to complete long-term stewardship activities by 2070. LRRI is forecasted to complete long-term stewardship activities in 2010.

One additional site is under the Albuquerque Operations Office where DOE will not have long-term stewardship responsibility: the South Valley Superfund Site. Since the Department is not expected to have responsibility for long-term stewardship after remediation is complete, costs were not included for this site.

<sup>55</sup> All costs in thousands of constant 2000 dollars.



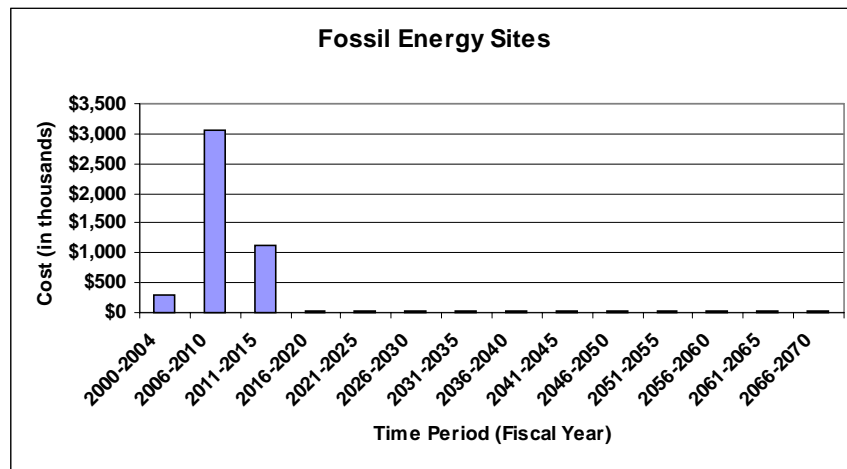
The Waste Isolation Pilot Plant (WIPP) is the only site in the Carlsbad Operations Office. WIPP is not projected to close until 2039, when DOE is expected to complete decontamination and decommissioning activities at the site. Therefore, long-term stewardship costs do not begin until 2040. Long-term stewardship costs are for maintaining active institutional controls. The expected long-term stewardship costs are anticipated to remain constant after 2040.



The Chicago Operations Office has four sites that will require long-term stewardship: Argonne National Laboratory-East (ANL-E), Brookhaven National Laboratory (BNL), Fermi National Accelerator Laboratory, Princeton Plasma Physics Laboratory. The Brookhaven National Laboratory represent nearly 80 percent of all long-term stewardship costs for the Chicago Operations Office. Therefore, projected long-term stewardship costs for the Chicago Operations Office closely mirror those of the Brookhaven National Laboratory. Cost estimates for the Chicago Operations Office peak during 2006-2010 period when costs for the Brookhaven National Laboratory are at their highest.

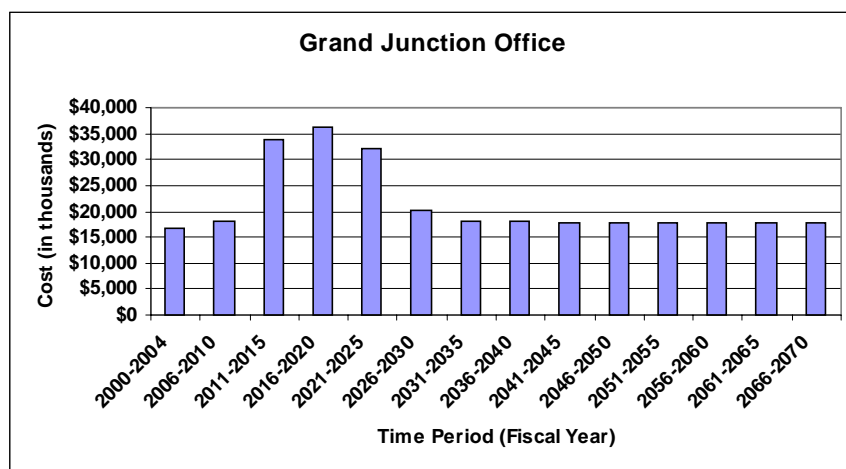
Costs for the Chicago Operations Office begin to drop in 2011, when the long-term stewardship programs at BNL and ANL-E (the site with the next highest long-term stewardship cost estimate) mature and have fewer high cost activities. Long-term stewardship costs will continue to gradually decrease at each of these sites until the projected long-term stewardship end dates of 2033 for ANL-E and 2035 for BNL. Smaller long-term stewardship commitments will end earlier for the two remaining Chicago Operations Office sites, the Princeton Plasma Physics Laboratory and the Fermi National Accelerator Laboratory, in 2010 and 2015 respectively.

One additional site is under the Chicago Operations Office where DOE will not have long-term stewardship responsibility: the Ames Laboratory in Iowa. Since the Department is not expected to conduct long-term stewardship, other than record-keeping activities, after remediation is complete, costs were not included for this site.



The majority of long-term stewardship costs for the four fossil energy sites (the Hoe Creek Underground Coal Gasification Site, the Naval Oil Shale Reserves Site, the Naval Petroleum Reserve No. 3 Landfill/Landfarm, and the Rock Springs Oil Shale Retort Site) are in the first 15 years, when the long-term stewardship costs for these sites consist of short-lived monitoring requirements. The vast majority of the costs are associated with two sites; the Hoe Creek Underground Gasification Site and the Rock Springs Oil Shale Retort Site. Costs continue beyond 2070 for two of the fossil energy sites (the Naval Oil Shale Reserves Site and the Naval Petroleum Reserve No. 3 Landfill/Landfarm), but are relatively small and are expected to remain constant.

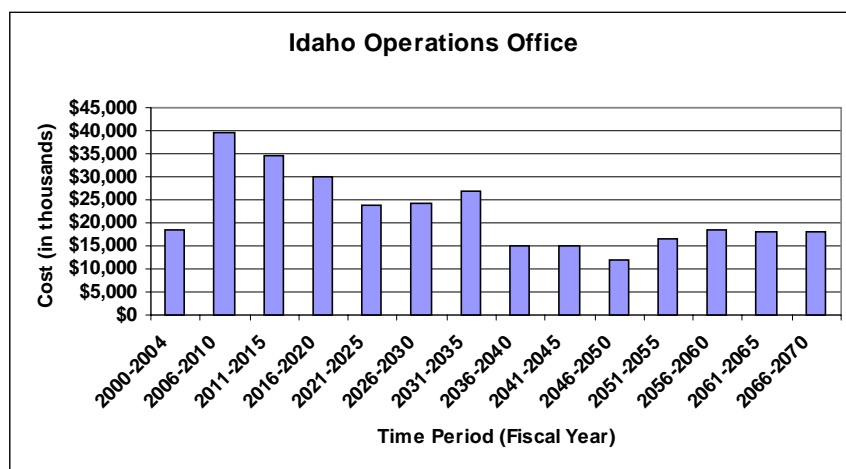




The Grand Junction Office has 67 sites that require long-term stewardship. Long-term stewardship costs peak between 2011 and 2025. These costs are largely attributable to the groundwater monitoring activities at the various sites. During the 2011-2025 time frame, ten sites are scheduled to begin long-term stewardship activities, including nine UMTRCA Title II sites and the Pinellas STAR Center. The Cheney Cell, the Monument Valley Site, the Shiprock Site, and the Tuba City Site have the largest long-term stewardship costs among the sites under the Grand Junction Office.

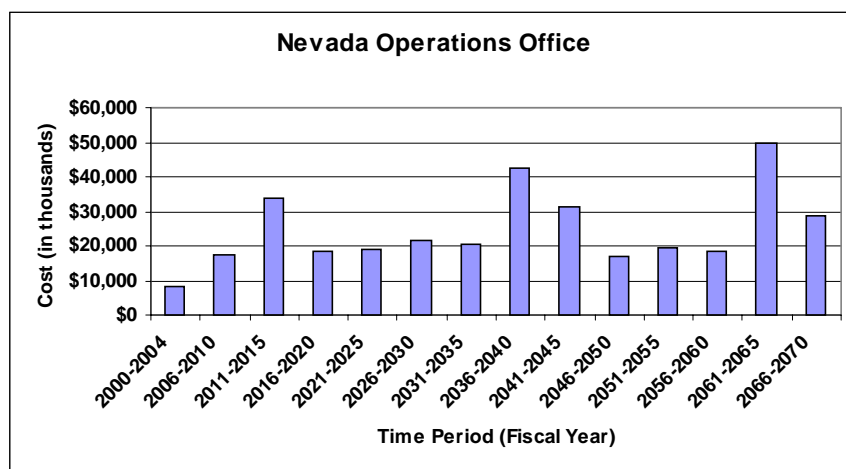
As the long-term stewardship program matures, monitoring requirements diminish for some of the sites in the Grand Junction Office. The effect of these reductions, particularly for groundwater monitoring, begin to take effect during the 2021-2025 time period and are visible in the graphic above. However, some of these decreases are offset by a cost increase at the Cheney Disposal Cell. In 2026, the remaining open section of the Cheney Disposal Cell is scheduled to close, at which time long-term stewardship activities will be conducted across the entire site.

Beginning in 2026, the total projected long-term stewardship costs for the Grand Junction Office remain fairly constant through 2070. The remaining costs are primarily for activities associated with groundwater monitoring, disposal cell monitoring, and repair and maintenance.

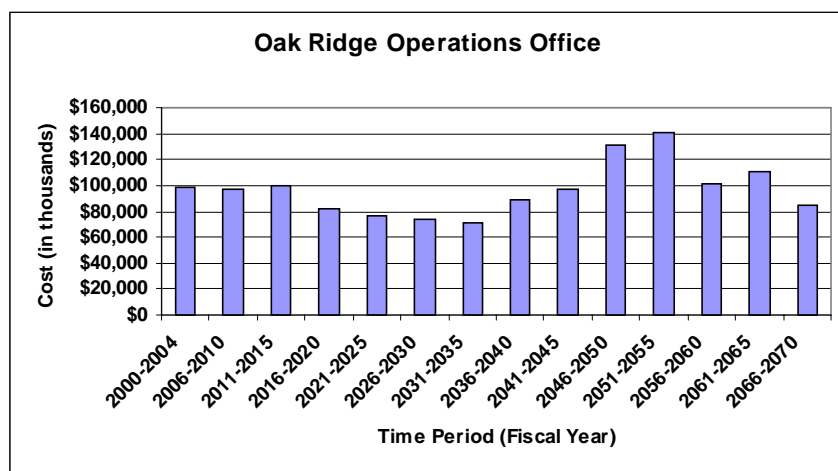


Site-wide remediation for INEEL is not scheduled to be completed until 2050, which explains a subtle increase in long-term stewardship costs in 2051-2055. However, long-term stewardship costs for INEEL peak during earlier years when monitoring requirements along with other long-term stewardship activities are expected to be most extensive. DOE anticipates that after 2070, INEEL's overall long-term stewardship cost estimate will continue to decrease slightly.

The major long-term stewardship activities that contribute to the Idaho Operations Office's cost estimate include engineered controls monitoring and maintenance (e.g., engineered unit caps and soil caps); quarterly groundwater monitoring; enforcing institutional controls, including access restrictions, for decontaminated and decommissioned facilities, residually contaminated soils, engineered units, and groundwater; and conducting CERCLA five-year reviews of those areas where residual contamination remains.



The Nevada Operations Office has nine sites that will require long-term stewardship. The Nevada Test Site's long-term stewardship activities represent the majority of the Nevada Operations Office's long-term stewardship cost estimate. The significant spikes in the Nevada Test Site's long-term stewardship cost estimate and, therefore, the Operations Office's cost estimate, are the result of well replacement activities approximately every 25 years at the site's underground test areas. Additional activities that contribute to the Nevada Operations Office cost estimate include air and groundwater monitoring. Aside from the Nevada Test Site, the other individual site cost estimates that comprise the Nevada Operations Office's long-term stewardship costs remain virtually unchanged across the seventy-year period, but also have small spikes approximately every 25 years for well replacement.

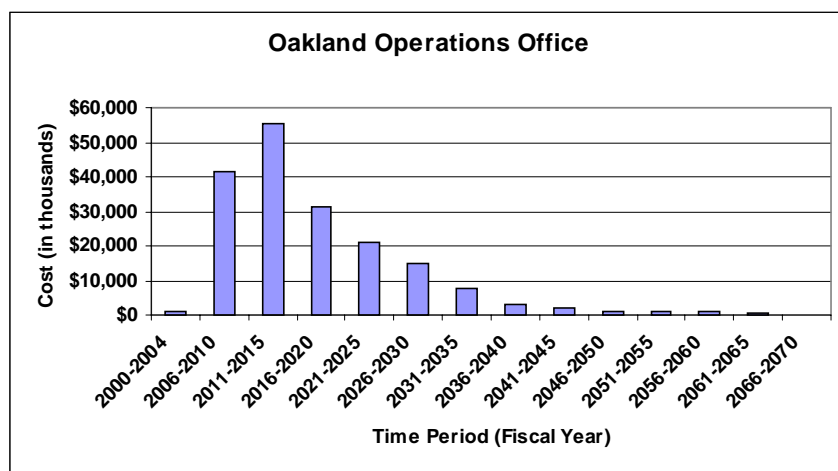


The Oak Ridge Operations Office's long-term stewardship cost estimate is composed of the long-term stewardship cost estimates for five sites: Bayo Canyon, the Center for Energy and Environmental Research, the Oak Ridge Reservation, the Paducah Gaseous Diffusion Plant, and the Portsmouth Gaseous Diffusion Plant. However, three sites (the Oak Ridge Reservation, Paducah Gaseous Diffusion Plant, and Portsmouth Gaseous Diffusion Plant) are primary contributors to the overall operations office cost estimate.

The long-term stewardship cost estimates for the other two sites (Bayo Canyon and the Center for Energy and Environmental Research) are small and remain constant between 2000 and 2070.

Generally, the long-term stewardship cost estimates for the three major sites or the overall operations long-term stewardship cost estimate decrease between 2000 and 2070, as monitoring requirements subside. The major long-term stewardship activities at these sites include groundwater monitoring and treatment; surface water monitoring and treatment; engineered barrier maintenance; monitoring, maintenance, and replacement of engineered controls; and institutional controls enforcement. However, some cost increases occur later due to scheduled replacement activities (e.g., cap replacement, water treatment and monitoring component replacement).

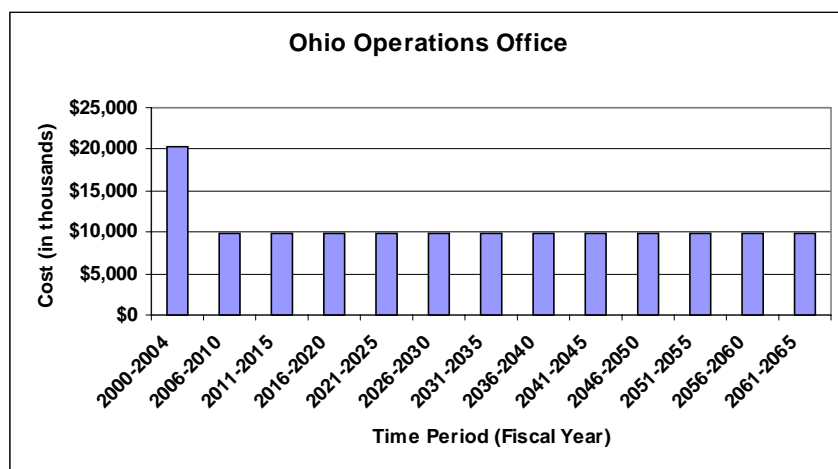
Two additional sites are under the Oak Ridge Operations Office where DOE will not have long-term stewardship responsibility: Maxey Flats Disposal Site and the Westlake Disposal Site. Since the Department is not expected to have responsibility for long-term stewardship after remediation is complete, costs were not included for these sites.



The Oakland Operations Office's long-term stewardship cost estimate is composed of the individual cost estimates of four sites: Lawrence Livermore National Laboratory - Livermore Site, Lawrence Livermore National Laboratory - Site 300, Berkeley National Laboratory, and the Stanford Linear Accelerator.

Only one of the four sites, the Stanford Linear Accelerator Center, is expected to begin accruing long-term stewardship costs during the initial period (2000-2004). The remaining three sites (Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory-Livermore Site, and Lawrence Livermore National Laboratory-Site 300) begin reporting long-term stewardship costs during the second period (2006-2010), explaining the large increase in the projected long-term stewardship costs (approximately \$40.6 million) between the 2000-2004 and 2006-2010 periods. The significant long-term stewardship activities at these sites include soil vapor extraction, subsurface barrier maintenance, well maintenance and operation, groundwater monitoring, and possibly active groundwater remediation. Only two sites (Lawrence Livermore National Laboratory-Livermore Site and Lawrence Livermore National Laboratory-Site 300) are expected to continue long-term stewardship activities beyond 2065.

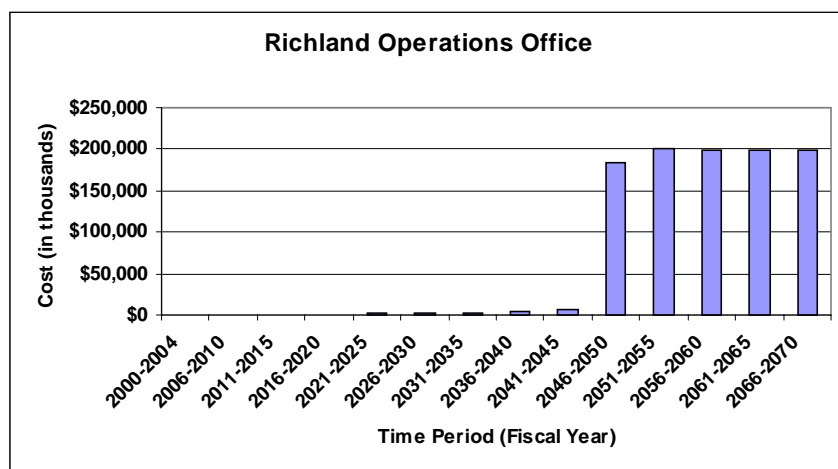
Four additional sites are under the Oakland Operations Office where DOE will not have long-term stewardship responsibility: the Energy Technology Engineering Center, General Atomics, General Electric Vallecitos Nuclear Center, and the Laboratory for Energy Related Health Research. Since the Department is not expected to have responsibility for long-term stewardship after remediation is complete, costs were not included for these sites.



The Ohio Operations Office's long-term stewardship cost estimate is comprised of two sites: the Fernald and Miamisburg Environmental Management Project sites. The high cost estimate for long-term stewardship activities during the first five-year period (2000-2004) is attributable to long-term stewardship activities at Fernald. After the initial five-year period, the Ohio Operations Office's long-term stewardship cost estimate remains constant at nearly \$10 million for each of the remaining five-year periods. The primary long-term stewardship activities at the sites within the Ohio Operations Office include site monitoring with associated sampling, analysis, and reporting; maintenance activities; leachate removal and treatment; disposal cell monitoring; groundwater monitoring; and enforcement of institutional controls.

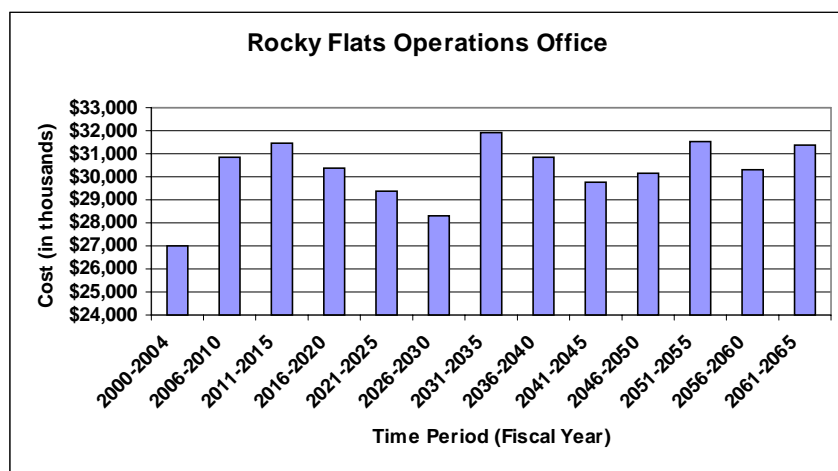
Four additional sites are under the Ohio Operations Office where DOE will not have long-term stewardship responsibility: the Ashtabula Environmental Management Project (*RMI Titanium Company Site*), Battelle Columbus-King Avenue, Battelle Columbus-West Jefferson, and the West Valley Demonstration Project.<sup>56</sup> Since the Department is not expected to have responsibility for long-term stewardship after remediation is complete, costs were not included for these sites.

<sup>56</sup> Long-term stewardship responsibilities for the West Valley Demonstration Project are yet to be determined.



The costs for the Richland Operations Office are represented by the Hanford Site. For the purposes of this Report the long-term stewardship costs for the Office of River Protection have been combined with the Richland Operations Office estimates. Although long-term stewardship activities began prior to 2000, the significant long-term stewardship costs are not expected until the completion of remediation at critical areas of the site, such as the Environmental Restoration Disposal Facility and the high level waste tank farm. The completion of site-wide remediation is not scheduled until 2048. Consequently, the many long-term stewardship costs are scheduled to begin following the completion of remediation for the entire site. Also, ongoing activities (i.e., access restrictions) which are currently categorized under other budget categories will fall under long-term stewardship responsibilities after the completion of site-wide cleanup.

The Hanford Site will determine the specific institutional controls, and surveillance and maintenance activities for each area as the remediation activities are completed. However, the major ongoing or anticipated activities in the site's long-term stewardship cost estimate are: institutional controls enforcement (including deed restrictions), radiological surveys (reactors), confinement systems repair (reactors), air monitoring, effluent monitoring, surface contamination monitoring, vegetation growth control and contaminated vegetation removal (contaminated soil), semi-annual groundwater monitoring, and facility repairs (major facility repairs every five years and roof replacement every 20 years).



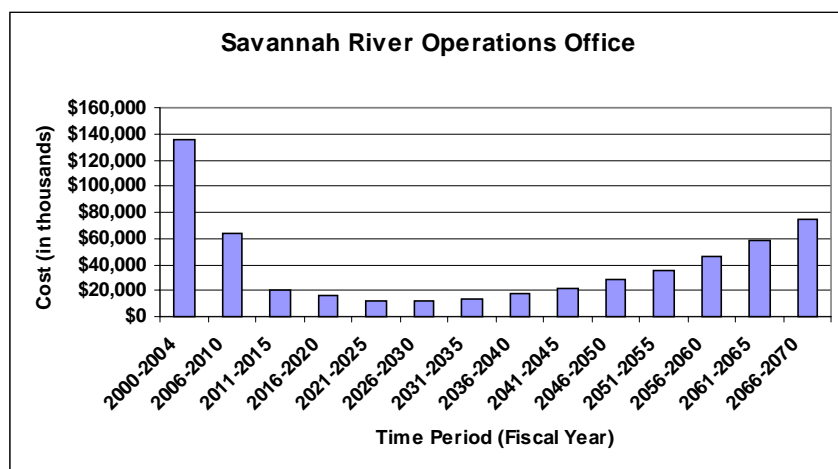
The Rocky Flats Operations Office consists solely of the Rocky Flats Environmental Technology Site. Remediation of this site is scheduled to be complete by 2006. Therefore, no long-term stewardship costs are reported between 2000-2005. Costs are expected to remain relatively constant throughout the following years and are dedicated for a number of long-term stewardship activities, including: groundwater and surface water monitoring, passive groundwater treatment, cap maintenance (if caps are needed), and ecological monitoring in the site's buffer zone.

DOE expects that if caps are needed as engineered barriers for facility foundations, the Solar Evaporation Ponds, and the Present Landfill, they will require period inspections, including the surrounding vegetation. Leachate collection and passive groundwater treatment at the Present Landfill are expected to continue during long-term stewardship. Weekly air sampling of the Present Landfill (and other engineered units if needed) and monthly analysis of the samples for particulate air quality will likely be required as part of the long-term stewardship activities.

The cost estimate assumes that the iron filings in each of the three groundwater treatment vessels (located at the Mound Site, the East Trenches, and the Solar Evaporation Ponds) will need to be replaced approximately every 10 years. The spent filings will be disposed of as low-level waste. A fourth passive groundwater treatment system may be installed to control the Industrial Area groundwater plume.

There are 89 groundwater monitoring wells on the site. Groundwater monitoring is expected to continue as part of the site's long-term stewardship program. The number of active groundwater monitoring wells may decrease over time. DOE estimates that groundwater monitoring will be the single greatest long-term stewardship cost for the site. Surface water is sampled monthly at eight locations on the site.





The Savannah River Operations Office consists solely of the Savannah River Site. High costs in the 2000-2004 period are due to significant pump and treat operations. These activities steadily decline during 2006-2010. A significant difference between the cost estimate for the Savannah River Site and other sites is that the estimate for the Savannah River Site only includes long-term stewardship costs for activities scheduled to begin by the end of 2006. The post-2006 activities are not included due to the high uncertainty in determining the extent of long-term stewardship activities. Therefore, the estimate provided is likely to be an underestimate of the Department's long-term stewardship cost obligation at the site. Also, the Savannah River Site assumes a standard cost increase for long-term care and maintenance of site facilities, which is expected to cause an upward trend for costs in later years.

The major long-term stewardship activities that drive the site's cost estimate include monitoring the closed tanks in the F and H Tank Areas (four tanks in the F Tank Area by the end of 2006); annually monitoring inactive site facilities; groundwater monitoring; engineered units monitoring, operation and maintenance of treatment facilities; maintenance of institutional (e.g., deed restrictions) and engineered controls (e.g., caps); and compliance support.



## APPENDIX H:

## COMPARISON OF STATUS REPORT ON PATHS TO CLOSURE AND REPORT TO CONGRESS, LONG-TERM STEWARDSHIP SITE LISTS

Sites that are included in the Report to Congress but are not included in the *Paths to Closure* report: 58

(ANC) Gas Hills Site  
Ashland Oil #1  
Ashland Oil #2  
Bliss and Laughlin Steel  
Bluewater Site  
Burrell Site  
Burro Canyon Disposal Cell  
CE  
(Chevron) Panna Maria Site  
Colonie  
(Conoco) Conquista Site  
(Cotter) Cañon City Site  
(Dawn) Ford Site  
DuPont & Company  
Edgemont Site  
(EFN) White Mesa Site  
Estes Gulch Disposal Cell  
(Exxon) Highlands Site  
(Exxon) Ray Point Site  
Fort St. Vrain  
(HECLA) Durita Site  
Hoe Creek Underground Coal  
Gasification Site  
(Homestake) Grants Site  
(Kennecott) Sweetwater Site  
Latty Avenue Properties  
Linde Air Products  
Lucky  
Madison  
Maywood Chemical Works  
Middlesex Sampling Plant

Naval Oil Shale Reserves Site  
Naval Petroleum Reserve No. 3  
Landfill/Landfarm  
Niagara Falls Storage Site  
Painesville  
Parkersburg Site  
(Pathfinder) Lucky Mc Site  
(Pathfinder) Shirley Basin Site 2  
(Petrochemicals) Shirley Basin Site 1  
(Plateau) Shootaring Canyon Site  
(Quivira) Ambrosia Lake Site 2  
(Rio Algom) Lisbon Valley Site  
Rock Springs Oil Shale Retort Site  
St. Louis Airport Site  
St. Louis Airport Site Vicinity  
Properties  
St. Louis Downtown Site  
Seaway Industrial Park  
Shpack Landfill  
(SOHIO) LBAR Site  
(UMETCO) Gas Hills Site  
(UMETCO) Uravan Site  
(UNC) Church Rock Site  
(Union Pacific) Bear Creek Site  
W.R. Grace and Company  
Wayne Site  
Westlake Disposal Site  
(WNI) Sherwood Site  
(WNI) Split Rock Site  
11(e)2 Disposal Site

Sites in the *Paths to Closure* report that have been divided into two or more sites in the Report to Congress: 7\*

(Durango, CO)  
Bodo Canyon Cell  
Durango Mill

(Maybell, CO)  
Maybell Mill Site  
(UMETCO) Mill Site 2

(Grand Junction Office)  
Cheney Disposal Cell  
Grand Junction Mill 1  
Grand Junction Mill 2

(Naturita, CO)  
Naturita Mill  
Naturita Site

(Salt Lake City, UT)  
Salt Lake City Mill  
South Clive Disposal Cell

(Gunnison, CO)  
Gunnison Disposal Cell  
Gunnison Mill Site

(Lakeview, OR)  
Lakeview Mill  
Lakeview Site

\* *Paths to Closure* site names are in parentheses.

Sites that are included in both *Paths to Closure* and the Report to Congress: 69\*

Ambrosia Lake Site (Ambrosia Lake, NM)  
Amchitka Island  
Ames Laboratory  
Argonne National Laboratory East  
Ashtabula Environmental Management Project  
(Atlas) Moab Mill  
Battelle Columbus - King Avenue (Columbus  
Environmental Management Project - King Avenue  
Battelle Columbus - West Jefferson (Columbus  
Environmental Management Project - West Jefferson)  
Bayo Canyon  
Brookhaven National Laboratory  
Canonsburg Site (Canonsburg, PA)  
Center for Energy and Environmental Research  
Central Nevada Test Area  
Energy Technology Engineering Center  
Falls City Site (Falls City, TX)  
Fermi National Accelerator Laboratory  
Fernald Environmental Management Project  
Gasbuggy Site  
General Atomics  
General Electric Vallecitos Nuclear Center  
Gnome-Coach  
Green River Site (Green River, UT)  
Grand Junction Mill 1 (Grand Junction Mill Tailings Site, CO)  
Hallam Nuclear Power Facility  
Hanford Site  
Idaho National Engineering and Environmental Laboratory  
Kansas City Plant  
Laboratory for Energy Related Health Research  
Lawrence Berkeley National Laboratory  
Lawrence Livermore National Laboratory - Livermore Site  
Lawrence Livermore National Laboratory - Site 300  
Lowman Site (Lowman, ID)  
Los Alamos National Laboratory  
Lovelace Respiratory Research Institute (Inhalation  
Toxicology Research Institute)  
Maxey Flats Disposal Site

Mexican Hat Site (Mexican Hat, UT)  
Miamisburg Environmental Management Project  
Monticello Remedial Action Project  
Monument Valley Site (Monument Valley, AZ)  
Nevada Test Site  
Oak Ridge Reservation  
Paducah Gaseous Diffusion Plant  
Portsmouth Gaseous Diffusion Plant  
Palos Forest (Site A/Plot M) Preserve  
(Site A/Plot M)  
Pantex Plant  
Pinellas STAR Center (Pinellas Plant)  
Piqua Nuclear Power Facility  
Princeton Plasma Physics Laboratory  
Project Shoal  
Rifle (New) Mill Site (New Rifle, CO)  
Rifle (Old) Mill Site (Old Rifle, CO)  
Rio Blanco  
Riverton Site (Riverton, WY)  
Rocky Flats Environmental Technology Site  
Rulison  
Salmon Site  
Sandia National Laboratories - CA  
Sandia National Laboratories - NM  
Savannah River Site  
Shiprock Site (Shiprock, NM)  
Slick Rock (North Continent) Mill 1 (Slick  
Rock Old North Continent, CO)  
Slick Rock (Union Carbide) Mill 2 (Slick  
Rock Union Carbide, CO)  
South Valley Superfund Site  
Spook Site (Spook, WY)  
Stanford Linear Accelerator (Stanford  
Linear Accelerator Center)  
Tuba City Site (Tuba City, AZ)  
Waste Isolation Pilot Plant  
Weldon Spring Site  
West Valley Demonstration Project

\* Site names in the *Paths to Closure* report are in parentheses if they differ from their corresponding names in the Report to Congress.

Sites that are included in the *Paths to Closure* report but are not included in the Report to Congress: 35

Acid/Pueblo Canyons  
Alba Craft  
Albany Research Center  
Aliquippa Forge  
Associate Aircraft  
B&T Metals  
Baker and Williams Warehouses  
Baker Brothers  
Belfield, ND  
Bowman, ND  
C.H. Schnoor  
Chapman Valve  
Chupadera Mesa  
Elza Gate  
General Motors  
Geothermal Test Facility  
Granite City Steel  
Herring-Hall Marvin Safe Co.  
Holloman Air Force Base  
Kauai Test Facility  
Kellex/Pierpont  
Middlesex Municipal Landfill  
National Guard Armory  
New Brunswick Site  
Niagara Falls Storage Site  
Vicinity Properties  
Oxnard Facility  
Pagano Salvage Yard  
Peak Oil PRP Participation  
Project Chariot  
Salton Sea Test Base  
Separation Process Research Unit  
Seymour Specialty Wire  
University of California  
University of Chicago  
Ventron

Sites in the *Paths to Closure* report that are considered portions of other sites in the Report to Congress: 3

Argonne National Laboratory West (INEEL)  
Oak Ridge Associated Universities (ORR)  
Tonopah Test Range (NTS)



## APPENDIX I: SUMMARY OF THE “LONG-TERM STEWARDSHIP TRANSITION TO SITE LANDLORD” POLICY

The Deputy Secretary has directed that the landlord Program Secretarial Officers shall be responsible for conducting the Long-Term Stewardship program at their sites, unless other arrangements are made. The objective of this policy is to initiate actions which will lead facilities to plan, budget and transition long-term stewardship activities in a timely fashion. The smooth transition of long-term stewardship responsibility depends on three important factors: (1) establishing a plan and an operating baseline for long-term stewardship activities; (2) determining and programming the resources and budget required to execute those activities; and (3) formalizing a memorandum of agreement to conduct those activities and to make continuous enhancements to the program.

Sites should consider the following factors when determining the appropriate long-term stewardship activities to ensure that Departmental Long-term stewardship objectives are met.

- A. **Monitoring hazards and maintaining engineered and institutional controls.** Understanding the relationship between technologies being implemented during cleanup and the long-term management of residual site hazards; operating and maintaining engineered and institutional controls; and performing surveillance, monitoring, and reporting associated with residual hazards. Includes developing and using new science and technology before cleanup to ensure decisions are based on the best science available.
- B. **Re-evaluating controls and strategies.** Periodically re-evaluating long-term stewardship strategies given changes in knowledge, science, and site conditions. Long-term stewardship is not simply the oversight of engineered barriers and technologies already put in place; it also determines the appropriate changes in engineered/institutional controls based on new information and knowledge (e.g., changing cancer potency estimates).
- C. **Emergency response.** Responding to incidents onsite or offsite (e.g., fire and rescue); spills and other chemical releases; and natural disasters (e.g., earthquakes, tornadoes). Emergencies may directly involve residual hazards (e.g., discovery of new contamination) or may involve such hazards indirectly (e.g., a fire may sweep across areas containing residual hazards).
- D. **Compliance oversight.** Ensuring that: established standards or early warning "triggers" are not exceeded; protection of health, safety, and the environment is adequate; and monitoring data and other information are being collected and disseminated in accordance with existing requirements.
- E. **Resource management.** Activities related to managing natural, mineral, land, and cultural resources onsite and offsite. Some resources (e.g., endangered species, cultural resources) may require special protection unrelated to the primary long-term stewardship mission.
- F. **Administrative support.** Includes annual budget preparation; status reporting to Congress and others; policy or regulatory analyses; business management (e.g., payroll, accounting); maintaining roads and infrastructure; providing safeguards and security; and supporting research, development, and implementation of new technologies to address residual hazards.
- G. **Site redevelopment.** Economic redevelopment of the site after cleanup is complete, including re-use of existing facilities or infrastructure; construction of new facilities or infrastructure; and revising land and resource use restrictions as new information and knowledge become available.

- H. **Mission planning.** Planning for new site missions, including siting, design and operation of the mission (including construction or modification of facilities); demobilization of the mission; cleanup; and additional long-term stewardship activities.
- I. **Community planning.** Conducted primarily by State, local, and tribal governments, includes siting of roads, schools, hospitals, residences, and other important infrastructure; supporting decisions regarding zoning and other land use issues; granting of easements and other "rights of way;" and economic development in communities surrounding the site.

## Glossary





## GLOSSARY

**Active Long-Term Stewardship:** The direct performance of continuous or periodic custodial activities, such as controlling access to a site by means other than passive institutional controls, controlling or cleaning up releases from a site, performing maintenance operations on remediated areas at a site, or monitoring performance parameters at a disposal or release site.

**Activity:** The rate at which radioactive material emits radiation. Stated in terms of the number of nuclear disintegrations occurring in a unit of time, the common unit of radioactivity is the curie (Ci).

**Agricultural Land Use:** Unfenced areas where subsistence or commercial agriculture predominates without any restrictions on surface or groundwater use.

**Atomic Energy Act:** The Federal law created in 1946 to create a virtual monopoly on uses of nuclear energy and information within the U.S. Atomic Energy Commission. Substantially amended in 1954 to promote and regulate the production and uses of atomic power, with minor amendments since then.

**Atomic Energy Commission (AEA):** The Federal agency created by the United States Congress in 1946 (through the Atomic Energy Act) as the civilian agency responsible for uses of nuclear energy, including development of nuclear weapons. It also regulated the private use of radioactive materials and promoted energy development. In 1974, its weapons production and research activities were transferred to the Energy Research and Development Administration (ERDA), and its regulatory responsibility was given to the new Nuclear Regulatory Commission (see Energy Reorganization Act of 1974). The functions of ERDA were transferred to the U.S. Department of Energy in 1977.

**Background Concentration:** The concentration of a substance in an environmental media (air, water, or soil) that occurs naturally and is not the result of human activities.

**Base Case:** The estimated total program cost (i.e., reported in the 1995 and 1996 Baseline Environmental Management Reports) that reflects the most likely activities and schedule under current projections.

**Berm:** A mound or wall of earth; a narrow shelf, path, or ledge typically at the top or bottom of a slope.

**Biodegradation:** The breakdown of a substance by living things (as microorganisms) into innocuous products.

**Burial Grounds:** Areas designated for near-surface disposal of containers of low-level radioactive waste and obsolete or worn-out radioactively contaminated equipment.

**Byproduct:** Radioactive material from producing or processing nuclear materials. Some waste, materials, and contaminated media have beneficial commercial uses.

**Canyon:** A vernacular term for a chemical separations plant, inspired by the plant's long, high, narrow structure (e.g., the Savannah River Site's F and H Canyons). However, not all chemical separations plants are canyons.

**Characterization:** Sampling, monitoring, and analysis activities to determine the extent and nature of contamination at a facility or site. Characterization provides the necessary technical information to develop, screen, analyze, and select appropriate cleanup techniques.

**Clean Closure:** Closure of a site by removal or decontamination of contaminated materials. All hazardous wastes have been removed from a given Resource Conservation and Recovery Act (RCRA) regulated unit and any releases at or from the unit have been remediated so that further regulatory control under RCRA Subtitle C is not necessary to protect human health and the environment. As part of meeting the clean closure performance standard, facility owners/operators must remove all wastes from the closing unit and remove or decontaminate

all waste residues, contaminated containment system components, contaminated soils (including groundwater and any other environmental media contaminated by releases from the closing unit), and structures and equipment contaminated with hazardous waste and hazardous waste leachate to the extent necessary to protect human health and the environment.

**Cleanup:** The process of addressing contaminated land, facilities, and materials in accordance with applicable requirements. Cleanup does not imply that all hazards will be removed from the site. The term “remediation” is often used synonymously with cleanup. See also “environmental restoration.”

**Cocooning:** (See Entombing).

**Cold War Mortgage:** The cost and effort associated with addressing the environmental legacy of 50 years of nuclear weapons production.

**Completion of Cleanup:** A condition in which cleanup of a site is considered complete or when deactivation or decommissioning of all facilities currently in the Environmental Management program has been complete, excluding any long-term surveillance and monitoring; all releases to the environment have been cleaned up in accordance with agreed-upon cleanup standards; groundwater contamination has been contained or long-term treatment or monitoring is place; nuclear material and spent fuel have been stabilized and/or placed in safe long-term storage; and “legacy” waste (i.e., waste produced by past nuclear weapons production activities, with the exception of high-level waste) has been disposed of in an approved manner.

**Compliance Agreement:** Legally binding agreement between regulators and regulated entities that sets standards and schedules for compliance with environmental statutes.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):** Public Law 96-510, 42 U.S.C. 9601 et seq.: a Federal law (also known as Superfund), enacted in 1980 and reauthorized in 1986, that provides the

legal authority for emergency response and cleanup of hazardous substances released into the environment and for the cleanup of inactive waste sites.

**Comprehensive Land Use Planning:** A required site planning and management system to develop and maintain current and future land use plans and any type of development, use, or disposal planning for the site. Stakeholders are involved in development of Comprehensive Land Use Plans.

**Consent Decree:** A legally binding document that delineates actions previously agreed upon by the parties. In the case of DOE, a Consent Order outlines planned DOE actions to remediate environmental problems in return for the other party's consent to cease litigation.

**Constant Dollars:** A term that represents a dollar value adjusted for changes in prices. Dollars in the future are adjusted to strip out inflation by dividing current dollar amounts by an appropriate index, a process known as deflating. The result is a constant dollar series as it would exist if prices and transactions were the same in all subsequent years as the base year. Any changes in such a series would reflect only changes in the real volume of goods and services. This Report's cost projections are in thousands of constant 2000 dollars.

**Contaminant:** Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

**Contaminant of Concern:** Radionuclide or nonradionuclide contaminants that pose a risk to human health or the environment and are addressed by the remedial alternatives.

**Controlled Access Land Use:** DOE maintains restricted access for secure storage or disposal of nuclear materials or waste. Barriers and security fences prevent access by unauthorized persons. Wildlife and plants are controlled or removed.

**Curie (Ci):** A unit of radioactivity equal to 37 billion disintegrations per second (i.e., 37 billion becquerels); also a quantity of any radionuclide or mixture of radionuclides having one curie of

radioactivity.

**Decommissioning:** Retirement of a nuclear facility, including decontamination and/or dismantlement.

**Decontamination:** Removal of radioactive or hazardous contamination by a chemical or mechanical process.

**Disposal Cell:** An engineered unit or waste disposal and containment structure that is designed to safely store waste for extended periods and prevent escape of contaminants to the surrounding environment. The disposal cell may include a multi-layered cover which inhibits the escape of contaminants, prevents wind and water erosion of the contaminated materials in the cell, and prevents precipitation from percolating through the waste.

**DNAPLs:** An acronym for dense, non-aqueous phase liquids. DNAPLs are composed of one or more organic contaminants, do not mix with water, and are denser than water. The most common DNAPLs contaminants in groundwater are chlorinated solvents.

**Department of Energy (DOE):** The cabinet-level U.S. Government agency responsible for nuclear weapons production, energy research, isotope production, and the cleanup of hazardous and radioactive waste at its sites. It was created from the Energy Research and Development Administration and other Federal Government functions in 1977.

**DOE Office of Environmental Management:** An office of DOE that was created in 1989 to oversee the Department's waste management and environmental cleanup efforts. Originally called the Office of Environmental Restoration and Waste Management, it was renamed in 1993.

**Disposition:** Recycling and reuse, sale, transfer, storage, treatment, or disposal.

**Encapsulation:** A process whereby waste is placed and sealed in casks, cans, or other containers to prevent the material from moving through the environment.

**End State:** The physical state of a site after agreed upon remediation activities have been completed.

**Energy Reorganization Act of 1974:** The Federal law that divided the Atomic Energy Commission (AEC) into the Energy Research and Development Agency (ERDA) and the Nuclear Regulatory Commission (NRC). The weapons and research portions of AEC were transferred to ERDA and later merged into DOE (1977). The regulatory aspects of AEC were assigned to the Nuclear Regulatory Commission.

**Engineered Controls:** Includes radioactive, hazardous, and sanitary landfills; vaults; repositories; in-situ stabilization; caps on residual contamination; or other man-made controls designed to isolate or to contain waste or materials.

**Engineered Units:** Includes radioactive, hazardous, and sanitary landfills; vaults; tank farms; and other units with manmade containment systems.

**Enriched Uranium:** Uranium that, as a result of the process of enrichment, has more uranium-235 than natural uranium.

**Entombment:** An alternative for dispositioning surplus facilities by burial or covering in a vault.

**Environmental Contamination:** The release into the environment of radioactive, hazardous, or toxic materials.

**Environmental Impact Statement (EIS):** The detailed written statement that is required by Section 102(2)(C) of the *National Environmental Policy Act (NEPA)* for a proposed major Federal action that could significantly affect the quality of the human environment. A DOE EIS is prepared in accordance with applicable requirements of the Council on Environmental Quality's *NEPA* regulations in 40 CFR Parts 1500-1508, and the DOE *NEPA* regulations in 10 CFR 102.1. The statement includes, among other information, discussions of the environmental impacts of the proposed action and all reasonable alternatives, adverse environmental effects that cannot be avoided should the proposal be implemented, the

relationship between short-term uses of the human environment and enhancement of long-term productivity, and any irreversible and irretrievable commitments of resources.

**Environmental Protection Agency:** A Federal agency established in 1970 to enforce environmental laws, including the *Resource Conservation and Recovery Act*; the *Comprehensive Environmental Response, Compensation, and Liability Act*; and the *Toxic Substances Control Act*.

**Environmental Restoration:** Often described broadly as "cleanup," this function encompasses a wide range of activities, such as stabilizing contaminated soil; treating groundwater; decommissioning process buildings, nuclear reactors, chemical separations plants, and many other facilities; and exhuming sludge and buried drums of waste.

**Feasibility Study:** An analysis of the practicality of a proposal, such as a description and analysis of the potential cleanup alternatives for a site. The Feasibility Study emphasizes data analysis and usually recommends selecting a cost-effective alternative. It is usually performed with and uses physical engineering measures, such as treatment and containment systems.

**Federal Facility Agreement:** A type of compliance agreement under Section 120 of the *Comprehensive Environmental Response, Compensation, and Liability Act*, which requires written interagency agreements for compliance activities between the U.S. Department of Energy and the U.S. Environmental Protection Agency.

**Finding of Suitability for Transfer (FOST).** FOST determines that the property is suitable for transfer by deed for the intended purpose, if known, because the requirements of *CERCLA* Section 120(h)(3) have been met for the property, taking into account the potential risk of future liability.

**Fiscal Year:** A 12-month period for which an organization plans the use of its funds. In the Federal Government this period extends from

October 1 through September 30 of the following calendar year. Fiscal year is commonly denoted by its abbreviation "FY."

**Fissile:** Capable of being split by a low-energy neutron. The most common fissile isotopes are uranium-235 and plutonium-239.

**Formerly Utilized Sites Remedial Action Program (FUSRAP):** A Federal program initiated in 1974 to identify and remediate sites around the country that were contaminated during the 1940s and 1950s as a result of researching, developing, processing, and producing uranium and thorium, and storing the subsequent processing residues. In October 1997, the Energy and Water Development Appropriations Act for fiscal year 1998 transferred responsibility for the administration and execution of the FUSRAP program from DOE to the U.S. Army Corps of Engineers. At the time of transfer on October 13, 1997, DOE had completed the cleanup of 25 of the 46 FUSRAP sites.

**French Drain:** A drainage pipe.

**Funding Organization:** Agency which provides financial support for stewardship activities.

**Gaseous Diffusion:** The process used in the United States to enrich uranium-235 so that it is usable in weapons production and nuclear energy.

**Half-Life:** The time it takes for one-half of any given number of unstable atoms to decay to another nuclear form. Each isotope has its own characteristic half-life. They range from millionths of a second to billions of years.

**Hazard:** Materials or conditions that have the potential to cause adverse effects to health, safety, or the environment.

**Hazardous Waste:** A category of waste regulated under the *Resource Conservation and Recovery Act (RCRA, 42 U.S.C. 6901 et seq.)*. To be considered hazardous, a waste must be solid waste under *RCRA* and must exhibit at least one of four characteristics described in 40 CFR 261.20 through 40 CFR 261.24 (i.e., ignitability, corrosivity, reactivity, or toxicity) or be specifically listed by

the Environmental Protection Agency in 40 CFR 261.31 through 40 CFR 261.33. Source, special nuclear, or byproduct materials, as defined by the *Atomic Energy Act*, are not hazardous waste because they are not defined as solid waste under RCRA.

**High-Level Waste (HLW):** Highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid materials derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation.

**Highly Enriched Uranium:** Uranium with more than 20 percent of the uranium-235 isotope, used for making nuclear weapons and also as fuel for some isotope production, research, and power reactors. Weapons-grade uranium is a subset of this group.

**Holding Pond:** A structure built to contain large volumes of liquid waste to ensure that it meets environmental requirements prior to release.

**Hot Cells:** Heavily shielded compartments in which highly radioactive material can be handled, generally by remote control.

**In-Situ:** In its natural position or place.

**Institutional Controls:** Non-engineering measures – usually, but not always, legal controls – intended to affect human activities in such a way as to prevent or to reduce exposure to hazardous substances. Institutional controls include, but are not necessarily limited to: land and resource (e.g., water) use and deed restrictions; well-drilling prohibitions; building permits; and well use advisories and deed notices; and other legally enforceable measures. However, they are distinct from physical engineering measures, such as treatment and containment systems.

**Isotopes:** Any of two or more variations of an element in which the nuclei have the same number of protons (i.e., the same atomic number) but

different numbers of neutrons so that their atomic masses differ. Isotopes of a single element possess almost identical chemical properties but often different physical properties (i.e., carbon-12 and -13 are stable, while carbon-14 is radioactive).

**Land Use:** The ultimate uses to be permitted for currently contaminated lands, waters, and structures at each Department of Energy installation.

**Land Use Control Assurance Plan (LUCAP):** A written installation-wide plan that sets out the procedure to assure that land use controls remain effective over the long-term for all areas at the particular installation where they are required.

**Landlord Activities:** Activities that involve the physical operation and maintenance of DOE installations. Specific tasks vary but generally include providing utilities, maintenance, and general infrastructure for the entire installation.

**Legacy Waste:** Any waste within a complex that was generated by past weapons production or research activities and is in storage awaiting treatment or disposal.

**Life-Cycle Cost Estimate:** All the anticipated costs associated with a project or program alternative throughout its life. This includes costs from pre-operations through operations or to the end of the alternative.

**Long-Term Stewardship:** Encompasses all activities required to maintain an adequate level of protection to human health and the environment posed by nuclear and/or chemical materials, waste, and residual contamination remaining after cleanup is complete.

**Low-Level Waste (LLW):** Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in Section 11e.(2) of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material.

**Manhattan Project:** The U.S. Government project

that produced the first nuclear weapons during World War II. Started in 1942, the Manhattan Project formally ended in 1946. The Hanford Site, Oak Ridge Reservation, and Los Alamos National Laboratory were created for this effort. The project was named for the Manhattan Engineer District of the U.S. Army Corps of Engineers.

**Maximum Contaminant Level (MCL):** The maximum permissible level of a contaminant in water delivered to any user of a public system. MCLs are enforceable standards.

**Mixed Waste:** Waste that contains both source, special nuclear, or byproduct material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous component subject to the *Resource Conservation and Recovery Act*.

**National Environmental Policy Act of 1969 (NEPA):** NEPA is the basic national charter for protection of the environment. It establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. Section 102(2) contains "action-forcing" provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires Federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and alternatives and other specified information.

**National Nuclear Security Administration:** DOE program that is responsible for carrying out DOE responsibilities to achieve national security objectives established by the President. These include, among other things, responsibility for nuclear weapons and for assisting in reducing the global nuclear danger by planning for and maintaining a safe, secure and reliable stockpile of nuclear weapons and associated materials, capabilities, and technologies in a safe, environmentally sound, and cost-effective manner.

**National Priorities List (NPL):** The Environmental Protection Agency's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term

remedial action under CERCLA. The list is based primarily on the score a site receives from the EPA Hazard Ranking System described in 40 CFR Part 300, Appendix A. EPA must update the NPL at least once a year.

**Natural Attenuation:** Cleanup process that relies on natural processes to remediate contamination (e.g., radioactive decay, biodegradation, dispersion, dilution, sorption, volatilization, chemical or biological stabilization, transformation, or destruction of the contaminants).

**Natural Flushing:** A passive groundwater remediation technique which uses natural groundwater movement and geochemical processes to decrease contaminant concentrations. Criteria for use of natural flushing require that the contaminated groundwater is not a current or potential drinking water source. (See also "natural attenuation.")

**Nevada Offsites:** Underground nuclear tests conducted at eight locations in five different States (Alaska, Colorado, Mississippi, Nevada, and New Mexico) from 1957 to 1973. Tests were part of the Plowshare program to develop peaceful (industrial and scientific) applications for nuclear explosives and the Vela Uniform program to improve the capability of detecting, monitoring, and identifying underground nuclear detonations.

**No Further Action:** A determination made, based upon technical evidence, that remedial action is not warranted at a given site.

**Nuclear Reactor:** A device that sustains a controlled nuclear fission chain reaction.

**Nuclear Waste Policy Act (NWPA):** The Federal law that primarily provides for the development of Federal geologic repositories for disposal of high-level waste and spent nuclear fuel (amended several times since).

**Nuclear Weapons Complex:** The chain of foundries, uranium enrichment plants, reactors, chemical separation plants, factories, laboratories, assembly plants, and test sites that produced

nuclear weapons. Sixteen major U.S. facilities in 12 States formed the nuclear weapons complex.

**Open Space Land Use:** Posted areas reserved generally as buffer or wildlife management zones. Native Americans or other authorized parties may be allowed permits for occasional surface area use. Access to or use of certain areas may be prevented by passive barriers (e.g., where soil is capped). Limited hunting or livestock grazing may be allowed.

**Operable Unit:** Organizational unit used to clean up a site. It may address geographical portions of a site, specific site problems, or initial phases of an action. It may also consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site.

**Owner:** Entity who owns the deed to the property. In some instances, the owner leases the property to someone else, known as a landlord.

**Phytoremediation:** An innovative/emerging technology that utilizes plants to uptake toxic metals and radionuclides through roots in situ.

**Polychlorinated Biphenyls (PCBs):** A group of commercially produced organic chemicals used since the 1940s in industrial applications throughout commercial industry and the nuclear weapons complex. Polychlorinated biphenyls are found in many gaskets and large electrical transformers and capacitors in the gaseous diffusion plants and other DOE facilities. They have been proven to be toxic to both humans and laboratory animals.

**Potentially Responsible Party (PRP):** The *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) defines a PRP as any individual(s) or company(ies) identified as potentially liable under CERCLA for cleanup or payment for costs of cleanup of hazardous substance sites. PRPs may include individual(s) or company(ies) identified as having owned, operated, or in some other manner contributed wastes to hazardous substance sites.

**Plutonium (Pu):** A heavy, radioactive, metallic

element with the atomic number 94. It is produced artificially by neutron bombardment of uranium. Plutonium has 15 isotopes with atomic masses ranging from 232 to 246 and half lives from 20 minutes to 76 million years. Its most important isotope is fissile plutonium-239.

**Preliminary Remediation Goals (PRGs):** PRGs provide remedial design staff with long-term targets to use during analysis and selection of remedial alternatives. Ideally, such goals, if achieved, should both comply with applicable or relevant and appropriate requirements and result in residual risks that fully satisfy the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requirements for the protection of human health and the environment. By developing PRGs early in the decision-making process (before the remedial investigation/feasibility study and the baseline risk assessment are completed), design staff may be able to streamline the consideration of remedial alternatives.

**Pump-and-Treat System:** A system which extracts groundwater and removes contaminating substances before returning the water (e.g., recharge in injection wells) or disposing of it elsewhere.

**Production Reactor:** A nuclear reactor designed to produce manmade isotopes. Tritium and plutonium are made in production reactors. The United States has 14 such reactors: nine at the Hanford Site and five at the Savannah River Site. Some research reactors are also used to produce isotopes.

**Radioactive:** Of, caused by, or exhibiting radioactivity.

**Radioactivity:** The spontaneous transformation of unstable atomic nuclei, usually accompanied by the emission of ionizing radiation.

**Radioisotope or Radionuclide:** An unstable isotope that undergoes spontaneous transformation and emits radiation.

**Receptor:** Any human or other living thing that could be exposed and/or threatened by hazardous

or toxic contaminants.

**Record of Decision (ROD):** A public document that explains the cleanup alternatives to be used at National Priorities List sites under *CERCLA*. In addition, a ROD under *NEPA* is a concise public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared an environmental impact statement (EIS). The NEPA ROD is prepared in accordance with the requirements of the Council on Environmental Quality NEPA regulations (40 CFR 1505.2) and DOE's NEPA regulations (10 CFR 1021.315). A ROD identifies the alternatives considered by the agency and specifies the environmentally preferable alternative(s) evaluated, factors balanced by the agency in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and, if not, why they were not.

**Recreational Land Use:** Unfenced areas where daytime use for recreational activities (e.g., hiking, biking, sports), hunting, and some overnight camping is allowed. Fishing may be limited to catch-and-release.

**Remedy or Remedial Action (RA):** Those actions consistent with permanent remedy taken instead of, or in addition to, removal action in the event of a release or threatened release of a hazardous substance into the environment. A remedy or RA seeks to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment. The term includes, but is not limited to, such actions at the location of the release as storage, confinement, perimeter protection (using dikes, trenches, or ditches), clay cover, neutralization, cleanup of released hazardous substances and associated contaminated materials, recycling or reuse, diversion, destruction, segregation of reactive wastes, dredging or excavations, repair or replacement of leaking containers, collection of leachate and runoff, onsite treatment or incineration, provision of alternative water supplies, any monitoring reasonably required to assure that such actions protect the public health and welfare and the environment and, where

appropriate, post-removal site control activities. The term includes the costs of permanent relocation of residents and businesses and community facilities (including the cost of providing "alternative land of equivalent value" to an Indian tribe pursuant to *CERCLA* Section 126(b)) where EPA determines that, alone or in combination with other measures, such relocation is more cost-effective than, and environmentally preferable to, the transportation, storage, treatment, destruction, or secure disposition offsite of such hazardous substances, or may otherwise be necessary to protect the public health or welfare. The term includes offsite transport and offsite storage, treatment, destruction, or secure disposition of hazardous substances and associated contaminated materials. For the purpose of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the term also includes enforcement activities related thereto.

**Remedial Investigation:** The *CERCLA* process of gathering the data necessary to determine the nature and extent of contamination at a *CERCLA* site, establishing criteria for cleaning up the site, identifying preliminary alternatives for remedial action, and supporting the technical and cost analyses of the alternatives. The Remedial Investigation is usually done together with the Feasibility Study. Together, they are usually referred to as the "Remedial Investigation/Feasibility Study."

**Residential Land Use:** Unfenced areas where permanent residential use predominates. There is no restriction on surface water use, but groundwater use may be restricted.

**Research Reactor:** A class of nuclear reactors used to do research into nuclear physics, reactor materials and design, and nuclear medicine. Some research reactors also produce isotopes for industrial and medical use.

**Residual Contamination Standards:** The amount and concentrations of contaminants in soil, water, and other media that will remain following environmental management activities.

**Resource Conservation and Recovery Act**



**(RCRA):** A Federal law enacted in 1976 to address the treatment, storage, and disposal of hazardous waste.

**Rip Rap:** A rock layer which can be used to cover disposal cells.

**Risk:** Risk requires the presence of a hazard but, in addition to the hazard, considers the probability that the potential harm or undesirable consequences will be realized. Risk is expressed (qualitatively or quantitatively) in terms of the likelihood that an adverse effect will occur as a result of the existence of a hazard. The existence of a hazard does not automatically imply the existence of a risk since risk requires a pathway (to a receptor) for an exposure to occur. Barriers and other controls can block or eliminate the pathway and related risk from the residual hazard.

**Risk (in the context of human health):** The probability of injury, disease, or death from exposure to a hazard or a combination of hazards. In quantitative terms, risk is expressed in values ranging from zero (representing the certainty that harm will not occur) to one (representing certainty that harm will occur). The U.S. Environmental Protection Agency's Integrated Risk Information System expresses risk as follows:

- $10^{-1}$  = a risk of 1/10 (one person out of 10);
- $10^{-4}$  = a risk of 1/10,000 (one person out of 10,000);
- $10^{-6}$  = a risk of 1/1,000,000 (one person out of 1,000,000);
- $1.3 \times 10^{-3}$  = a risk of  $1.3/1,000 = 1/770$  (one person out of 770);
- $8 \times 10^{-3}$  = a risk of 1/125 (one person out of 125); and
- $1.2 \times 10^{-5}$  = a risk of 1/83,000 (one person out of 83,000).

**Site Characterization:** An onsite investigation at a known or suspected contaminated waste or release site to determine the extent and type(s) of contamination.

**Sludge:** Slushy matter or sediment, such as that precipitated by the treatment of waste.

**Spent Nuclear Fuel (SNF):** Fuel that has been

withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.

**Steward:** Individuals or groups responsible for performing and/or ensuring that the required long-term stewardship activities take place.

**Stockpile Stewardship:** A DOE program to ensure core competencies in activities associated with the research, design, development, and testing of nuclear weapons. It also refers to the assessment and certification of their safety and reliability.

**Superfund Amendments and Reauthorization Act (SARA):** (also known as Superfund) The 1986 Act reauthorizing and amending the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

**Target Cleanup Level:** A level of concentration of a contaminant in an environmental media (e.g., soil, groundwater) established in a CERCLA Record of Decision as a level to be achieved by the selected remedy.

**Toxic Substances Control Act (TSCA):** A Federal law enacted in 1976 to protect human health and the environment from unreasonable risk caused by the manufacture, distribution, use, disposal of, or exposure to substances containing toxic chemicals.

**Transuranic Elements:** All elements beyond uranium on the periodic table; that is, all elements with an atomic number greater than 92. All transuranic elements are man-made. They include neptunium, plutonium, americium, and curium.

**Transuranic Waste (TRU):** Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR, Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for

disposal on a case-by-case basis in accordance with 10 CFR, Part 61.

**Unrestricted Land Use:** Unfenced areas where there is no restriction on the types of activities that may occur, including permanent residential use.

**Uranium (U):** A radioactive, metallic element with the atomic number 92, the heaviest naturally occurring element. Uranium has 14 known isotopes, of which uranium-238 is the most abundant in nature. Uranium-235 is commonly used as a fuel for nuclear fission.

**Uranium Milling Site:** A site where uranium is separated from ore taken from mines.

**Uranium Mill Tailings:** Tailings or waste produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content.

**Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978:** The Act that directed DOE to provide for stabilization and control of the uranium mill tailings from inactive uranium milling sites in a safe and environmentally sound manner to minimize radiation health hazards to the public. It authorized the U.S. Department of Energy to undertake remedial actions at 24 designated inactive uranium processing sites and at an estimated 5,048 vicinity properties.

**Uranium Mill Tailings Remedial Action Project (UMTRA):** A DOE program to plan, implement, and complete environmental restoration (e.g. cleanup of contaminated surface water and groundwater) at inactive uranium-processing sites and their vicinity sites, as directed and authorized by the *Uranium Mill Tailings Radiation Control Act of 1978*.

**Vitrification:** A process by which waste is transformed from a liquid or sludge into an immobile solid that traps radionuclides and prevents waste from contaminating soil, groundwater, and surface water. While the process does not reduce radioactivity, it is used to solidify and stabilize certain forms of radioactive and hazardous waste. For example, borosilicate glass is used to immobilize high-level radioactive waste.

**Waste Isolation Pilot Plant (WIPP):** A DOE facility designed and authorized to permanently dispose of transuranic radioactive waste in a mined, underground facility in deep geologic salt beds. It is located in southeastern New Mexico, 42 kilometers (26 miles) east of the city of Carlsbad.

**Waste Management:** Activities that include treating, storing, and disposing of high-level radioactive waste, transuranic waste, transuranic mixed waste, low-level radioactive waste, low-level mixed waste, hazardous chemical waste, and sanitary waste.